A

LECTURE ON RESPIRATION:

BEING

THE SIXTH OF A SERIES

OF

PLAIN AND SIMPLE LECTURES

ON THE

EDUCATION OF MAN.

By THOMAS HOPLEY.

(*Written with a view to delivery in London.*)

> " Respiration is the falling weight, the bent spring, which keeps the clock in motion; the inspirations and expirations are the strokes of the pendulum which regulate it. In our ordinary timepieces, we know with mathematical accuracy the effect produced on their rate of going, by changes in the length of the pendulum, or in the external temperature. Few, however, have a clear conception of the influence of air and temperature on the health of the human body; and yet the research into the conditions necessary to keep it in the normal state, is not moro difficult than in the case of a clock."—Liebig's *Animal Chemistry*, p. 29.

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PREFACE.

The writer is aware that it is not customary to publish lectures before their delivery, much less to publish a single lecture of a series before the entire series can be offered to the public. He feels, however, that at a period when the cholera-plague is hovering over the country,* remarks on RESPIRATION are likely to meet with a degree of attention which would not be bestowed at a safer season. Either there is no value at all in the accompanying, or it will be of some little value now. With a hope, therefore, that it may prove not altogether void of utility, the *sixth* of a course of eight lectures is forwarded for publication.

At as early an opportunity as practicable with one whose time is much occupied with other important duties, it is proposed to deliver the entire course.

This first course will (D.V.) be followed at some future period by a second.

The scope and object of the series may be gathered from the *advertisement* (page v).

During the prosecution of his work, the writer has felt it necessary to make frequent applications to Sanitary and other Christian Societies, to public Boards and Offices, to gentlemen performing public duties, and to more private sources, for statistics of a great variety of matters bearing upon the mental and bodily health of man. He mentions this that he may have the pleasure of saying that whenever and wherever he has applied for information, whether personally or by letter, his requests have, with no single exception, met with the most courteous attention. By such valuable acts of kindness, for which he feels gratefully obliged, and by the further aid of published facts, amassed partly through the instrumentality of Government and partly through private philanthropy, but which united form a record of the country's physical and mental condition of more intrinsic worth, probably, than any record of like kind ever possessed by any nation of the world, he has hitherto found that task comparatively easy, which, without such assistance, would have been impracticable.

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* Written in July last.

EASTBOURNE, *July*, 1854.

[*January*, 1855.—A few weeks ago it was said, and with a degree of truth, that it was "not the time" for cleansing choked drains, &c., in as much as it was dangerous, while the epidemic was raging, to stir up the poison-beds of the country. It now remains to be seen whether the nation will energize, without delay, to root out pest-creating filth, or will again wait till the cholera again return to rebuke and chasten for neglected opportunities.—*See Note*, p. 37.]

(ADVERTISEMENT.)

PLAIN AND SIMPLE LECTURES

ON THE

EDUCATION OF MAN.

To be delivered, &c. . . . . *London*
for the benefit of, &c.

Mr. Hopley's object in undertaking these Lectures is two-fold :—*first*, To urge upon the serious consideration of such of the upper and middle classes of society as will favour him with a hearing, the fearful effects of certain errors existing in the systems under which their children are, for the most part, trained—errors requiring but determination among heads of families to be at once eradicated ; and *secondly*, To show to all whom he may have the power to address, something of the physical and mental condition of the national poor, who can never be rescued from the sin and misery which are at present forced upon them, save by the energetic strivings of large bodies of men and women who will work, not for the sake of pay or human applause, but through love of God and their neighbour.

To treat largely of so grand a theme as MAN'S EDUCATION in the compass of a few short lectures, is, of course, impossible ; but the writer is not without a hope that the facts on which he purposes arguing may create among his audience a desire to scrutinize them further, or may suggest to thoughtful minds other facts equally deserving serious attention.

Summary of the First Course of Lectures.

LECTURE I.—INTRODUCTORY.

Education the work of a whole life—Physically as well as mentally, "the child is the father of the man"—No sound theory of education unless based upon physiological principles

—Ill health not a part of man's nature—Perfect education depends on every organ of the system being properly exercised, and on the blood being in a healthy state—To effect these two requisites seven things necessary: due exercise of body, due exercise of mind, proper diet, pure air, habitual cleanliness, adequate clothing, regular and sufficient sleep.

Lecture II.—EXERCISE OF BODY.

The number of organs excited to activity during muscular exertion—Amount of exercise requisite for health—Impossibility of an ignorant nation being healthful—A glance at the overlaboured poor—All disease occasioned by departure from God's laws—Insufficient exercise among the higher classes—Every day's neglect of exercise a loss to the growing system of a day's development of every organ not excited to due activity.

Lecture III.—EXERCISE OF BODY—continued.

Effects of exercise after a hearty meal—Sanitary value of cultivating in young people a taste for Geology, Botany, Entomology, Ornithology, and Natural History generally—Reforms required in schools for females—Spinal curvature—A glance at the routine of a fashionable establishment for young ladies—A glance at needle-women and factory children—Deformities among the lace-manufacturers of Bedford, Nottingham, &c.—What has Government done for these?

Lecture IV.—DIET IN CONNEXION WITH EXERCISE.

All who infringe the law of exercise more or less dyspeptic—Indigestion a hinderance to the healthy building-up of all man's organs—Effects of unhealthy blood upon intellect and morality—Sedentary occupations throughout the kingdom—"Early closing movement"—The overworked labourer—Impossibility of his being anything but the dull incapable creature that he is—To increase the activity of the body, the activity of the mind must be increased—Sale of diseased meats, &c.—Purchased by masters for apprenticed children—Adulterations of food—Analytical Commission of "The Lancet"—Impure water—Selfishness, man's greatest enemy.

LECTURE V.—DIET—CONTINUED.

Growing children require in proportion more nourishment than adults—Error of pampering children's appetites—Effects of this error upon the brain, temper, intellect, and general development—Mistaken kindnesses—Disastrous results of mothers knowing nothing of the laws of health—Instruction in these laws should form a part of all school-teaching— Quacks and quackery—Amount of child-mortality in the world—Solemn responsibilities of parents.

LECTURE VI. (NOW IN THE HANDS OF THE READER.)

RESPIRATION.

The human lungs—Amount of air presented to the surface of the lung-cells—Changes of the vital fluids during their passage through the lungs—Ventilation—The homes of the rich—Cellar-dwellings and lodging-houses of Manchester, Liverpool, &c.—Homes of the labouring classes of London—The removable putridities of our country—Grave-yard gases and sewer gases of London—Their annual volume—The filthy state of the nation injurious to every member of society—"Preventable diseases."

LECTURE VII.—CLOTHING AND CLEANLINESS.

The skin an exhalant, absorbent, and secreting organ—Effects of torpidity of the skin upon the blood—Upon the brain—State of internal organs during undue coldness of the skin—Value of flannel clothing, especially to the poor—Animal heat—Why the narrow-chested dyspeptic feels the cold more than the broad-chested man of sound digestion—The young and the old require to be more warmly clad than the middle aged—Effects of cold upon the starving poor—Effects of tight clothing—Stays—Effects of a want of cleanliness upon mind and body—Importance of cleansing rooms after fever—Another glance at the poor—Who is responsible for their sin and misery?

LECTURE VIII.—SLEEP.—CONCLUSION.

Changes wrought upon the blood during the day—During the night—Organic effects of too little sleep—Late hours—Balls and theatres regarded as treats for children—State of their brains at the close of such entertainments—The young require more sleep than adults, the hard-working than the less laboriously employed—Another peep at our needlewomen, and other female operatives—The labourer—Effects of want of sleep on his blood—Sanitary condition of the nation generally—All movements for the erection of baths and wash-houses, or model lodging-houses, or for the ventilation of mines, factories, &c., or for improving the dwellings of the poor, or for cleansing towns, or for a better water-supply, or for promoting temperance, or for reducing the hours of toil, or for cheapening any of the necessaries of life, are movements in the cause of education—"Strikes"—Duty of the poor—Of the rich—Of parents—Of educators—Of legislators.

In the SECOND COURSE OF LECTURES it is proposed to treat at some considerable length, of moral and intellectual training as applicable to all classes of society—To consider to what extent moral training is neglected in the schools and colleges of the upper and middlle classes—To consider the question of school-punishments, and of punishments generally—To show how the nation compels the poor to crime, and then punishes them for being criminal—To show the cost of crime, ignorance, and preventable disease, and the saving that would arise from training the people morally and intellectually, and from carrying out sanitary reforms throughout the nation—To show that the mortality which is enforced upon the poor, so far from keeping-down population, tends to augment, in the long run, the numbers of that very class which are a great enfeeblement as well as an immense expense to the country—To show that the best means of out-rooting poverty, and the best means of hindering dissensions from arising between employers and employed, and the best means of defence against foreign foes, and the best means of enabling ourselves to help the progress of oppressed peoples, in a word, the best means of advancing our own happiness, and that of the world at large, is to improve the entire nation by sound sanitary reforms, and by giving to all classes of society a greater intellectual and moral power.

LECTURE VI.

RESPIRATION.

> "Nothing contributes more effectually to strengthen the constitution and render it capable of bearing the vicissitudes of climate than the constant respiration of *pure air*. On the other hand, nothing tends more certainly to weaken and relax the system, and render it susceptible of the impression of a cold and humid atmosphere, than breathing *impure* air."—Sir James Clark.

> "The means of preventing pestilential fevers are as much under the power of human reason and industry as the means of preventing the evils of lightning and common fire. I am so satisfied of this opinion, that I look for the time when our courts of law shall punish cities and villages for permitting any of the sources of malignant fevers to exist within their jurisdiction."—Dr. Rush (*America*).

Our theme this evening is RESPIRATION.

No organized being can exist without air. And why? Because no blood can be formed without air; and without blood there can be no organization, no function, no life.*

As blood is requisite for the organization of every structure and for the performance of every function, it follows that the greater the complexity of structure and the diversity of function possessed by any animal, the more efficient must be the systemic apparatus for blood-creation. Again, as no blood can be formed until food, after due preparation within the system, be brought into close proximity with the air—as, indeed, the amount of blood formed in any system will ever depend upon the amount of prepared food and the amount of pure air brought into immediate contact, it follows that the higher an animal ranks in the scale of creation, the more complete in arrangement must be that particular portion of the blood-creating apparatus designed for bringing prepared food and pure air into contact with each other. In other words, the higher an animal ranks in the scale of creation, the greater, *cœteris paribus*, must be the quantity of aliment which the respiratory organs are capable of presenting for aëration in a given time.

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* In making these broad statements, the elaborated fluid (cambium) of plants is regarded as their *blood*. Our present business, however, is entirely with *animal* life.

To say, then, that the human lungs are most exquisitely adapted for bringing into rapid contact with the air a very considerable quantity of fluid food, and that these organs are far more complex and complete in their arrangements than the respiratory apparatus of any other organized being, is only to say what every thinking mind must have already anticipated. But when we go on to consider that the structures now under review form, so to speak, the birth-place of the human blood, the cradle of new-created life, the temple where the ever-present power of God administers the finishing touch to that marvellous fluid on which every act, and word, and thought of life depends, we cannot but feel that though man is made-up of miracles, though every organ of his system is surpassingly wonderful, there is something here presents itself for contemplation wonderfully miraculous beyond all besides. When the spirit of creation has once touched the blood with life, we can conceive of its being gifted with the power of building-up brain, and muscle, and nerve, and everything; but how dead matter first becomes endowed with vitality —how, touched in the human breast by the breath of heaven, it instantly brightens and blushes into being, this baffles the human mind, and must ever remain among "the deep things of God" which pass man's understanding.

I would that it were in my power to adequately describe the structure of the human lungs. To say that they are so wonderfully designed—so exquisitely arranged, that it is utterly impossible to imagine aught in creation more admirably adapted for the performance of its appointed duty, is only to say what might with equal truth be affirmed of the brain, the heart, the eye, or any other God-created thing; but though all divine works are perfect, yet, as far as man is capable of judging, not even the sensitive eye, the beating heart, nor the thinking brain, can vie in delicacy of structure, in elaborate complexity of design, in exquisite minuteness of finish, with the organs now under consideration.

But though no words can fully paint their beautiful mechanism, we may be able to form some dim idea of the wonderful power displayed in their construction, by first contemplating the respiratory apparatus of a creature more lowly organized than man. With that of the fish we are all more or less familiar; and though there is but little resemblance between the gills of the water-breathing fish and the lungs of the air-breathing man, still, when the mind has reflected on the vast amount of respiratory surface constantly presented to the action of the water during its passage through the gills of the fish, it will then be better able, through the medium of comparison, to realize something of the delicate workings of the Creator's laws within the lungs of the human being.

Any one who has taken the trouble to carefully examine the fish's gill, will have observed that it consists of a compactly-arranged series of fringed folds, composed of very fine membrane, and disposed in delicate laminæ or leaves; each leaf being subdivided into a variety of leaflets, and these again being subdivided into minute tufts or fibres. Throughout the entire surface of these leaves, leaflets, tufts, and fibres, there is distributed a very closely-woven net-work of extremely minute blood-vessels; and upon each fresh gush of water passing through the gill during the process of respiration, every tiny leaf, leaflet, tuft, and fibre, is made to wave to and fro under the action of the stream; so that there is not a single point in any of the appendages that compose the gill—not a single point in the myriads of vessels exposed on these appendages, but must be laved by the current created. And thus it is that in the small space allotted to the gill of an ordinary fish, Nature has contrived that a surface equal to *several square feet*, all closely netted-over with hair-like blood-vessels, should be in constant contact with the element from which the blood contained in these vessels must receive its life. By this leaf-like disposition of delicate membrane, so ample a field is produced for the interweavement of capillaries, that the respiratory surface within the gills of the common skate has been computed to be *four times as extensive as the surface of the entire human body.** Through this vast surface every particle of the fish's blood must circulate—every particle "must be unceasingly bathed with fresh streams of water."

But here I may remind you that it is not water, *as water*, that vitalizes the fish's blood. It is the air conveyed to the blood through the medium of the water. A constant supply of air is absolutely requisite for all vitality—from the monad to the man. And when it is remembered that water possesses a peculiar power of absorbing and condensing aëriform fluids—a power so great as to enable it to take-up even "many times its own volume of certain gases"—it will at once be seen how effective are Nature's means of blood-aëration among her water-breathing creatures.

Now, reflecting on the fact that in order to duly vitalize the fluids circulating within the system of an ordinary fish *several superficial feet* of delicate, capillary net-work must be constantly presented to the action of the vitalizing element—the air in the water; and reflecting further, that the structural development of the respiratory organs in any vital system, must ever be strictly proportionate to the perfection of the general organization of the creature; and further, that the fish—furnished though it be with its myriads of capillaries weaved over many feet of respiratory surface—is but a member of the very lowest order of vertebrated animals, while man ranks on earth at the head of God's creation: remembering and reflecting on these facts, you may be able, I will not say to form a conception of the elaborate complexity of the human lungs, but to perceive that they must be complex and elaborate beyond conception. As far as man, in all his organs, in all his senses, in all his members, in his nervous, osseous, muscular, cutaneous, and sanguineous systems—in a word, in all his bodily and mental powers, is advanced beyond the finny tribe, so far is the mechanism of the human lungs delicate, intricate, and extensive beyond the respiratory apparatus of the water-breathing creatures.

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* Carpenter's Animal Physiology, § 312.

Without, then, vainly attempting a detailed description of these organs, I will simply state that their main bulk consists of very many millions of air-cells, all in the closest possible proximity with each other; and that every one of these cells is connected by a ramification of delicate air-tubes with the trachea or windpipe; so that with every inspiration, every point of the internal surface of every cell, comes into immediate contact with the air inspired; and so marvellously arranged are these cells for effecting the required object, that the surface furnished by them collectively is spacious beyond belief, save among those who have scrutinized the matter, and those who reflect what Power designed these organs.

Dr. Hales, some years ago, calculated this surface to be about 20,000 square inches. Another physiologist, Keil, supposing the number of cells to be about 174 millions, estimated the surface which they would present to the air at 21,906 square inches, or upwards of 150 square feet; while Dr. Monro thought it to be about thirty times the entire surface of the human body.* Now all this is sufficiently startling; and yet the researches of later physiologists prove that even the highest of these estimates falls very far short of the reality. It has been lately calculated by M. Rochoux, who has had at his command all the improved methods of microscopical investigation, "that as many as 17,790 air-cells are grouped around each terminal air-tube; and that their total number amounts to no less than 600 *millions.*"† Now, the calculations of Keil were based upon the supposition that the lungs contained no more than 174 millions of cells. Supposing, therefore, that Rochoux and Keil are in agreement concerning the average diameter of these vesicles, and the mode of determining their internal areas, then, calculating from Rochoux's enumeration of them, it would appear that the human lungs are unceasingly presenting to the action of the atmosphere a surface of 524 square feet, or upwards of 58 square yards.

But even this estimate, large as it may seem, is undoubtedly very much below truth. According to Dr. Hales, the diameter of each cell may be reckoned at the 100th of an inch; while according to the more recent researches of Professor Weber, the diameters vary between the 70th and the 200th of an inch. Now, estimating the internal surface of a single cell as about equal to that of a hollow globule of equal internal diameter, then, by adopting the measurement of Hales, we find that 600 million such cells would possess collectively a surface of no less than 145 square yards; but by basing our calculations on the opinions of Weber—opinions, remember, which the scientific world receives as facts—we arrive at the still more astounding conclusion, that *The human lungs possess upwards of one-hundred-and-sixty-six square yards of respiratory surface,* every single point of which vast surface is in constant and immediate contact with the atmosphere inspired.

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* Smith's Philosophy of Health, vol. ii. § 370.

† Carpenter's Principles of Human Physiology, § 758.

Now, one cannot but feel that such an assertion must to many appear incredible—impossible. To these I would say, Remember the gill of the humble skate; remember the low rank of the fish, and the dignified position of the man; that the developments of the fish, though delicately beautiful, are as far inferior to those of the man, as grains of sand to glittering diamonds; and then consider the unvarying law, "The higher an animal ranks in the scale of creation, the greater, *cæteris paribus,* must be the quantity of aliment which the respiratory organs are capable of presenting for aëration in a given time."* Were all this more reflected-on by the generality, so far from being incredulous as to the vast amount of respiratory surface presented in the human lungs, every thinking mind, reasoning from simple analogy, would, even before obtaining positive information on the matter, naturally anticipate that some such discovery would result from careful anatomical investigation. It will be useful, then, to imprint on the memory, that *Whether we breathe pure or putrid air, the air inspired is ever in immediate contact with upwards of one-hundred-and-sixty-six square yards of respiratory surface.* A sufficiently accurate idea may be formed of the extent of this surface, when we consider that it affords a space ample enough for the erection of two or three large houses.†

And now a few words on the *texture* of this vast area. The essential constituent of all lung-cells is what is termed *mucus membrane*—a membrane which, in the cells now under consideration, is of an exceedingly elastic nature; but, at the same time, so extremely thin, that I know not anything to which it might be likened. The cells in the lung of the toad have been compared to little soap-bubbles; but the mucus membrane of the human lungs far surpasses these in thinness. Yet it is this which forms the essential constituent of man's 600 million air-vesicles. Completely covering the interior walls of every one of these delicate cells is a net-work of blood-vessels, somewhat similar to that which is disposed over the various laminæ of the fish's gill, but far more wonderfully minute; so wonderful, indeed, in its minuteness, that though formed from vessels of such extreme tenuity, that a very considerable number of them would be required to make the thickness of a human hair, yet the meshes enclosed by these vessels are, according to Dr. Carpenter, even less in diameter than the vessels which enclose them.* Such is the texture of net-work, spreading, as we have seen, over many hundreds of square feet of surface, constantly presenting the blood for aëration.

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* Text, p. 10.

† See Appendix No. I. p. 56.

Streaming through these tiny vessels, there is ever present in the lungs at least one-half pound of blood. At every beat of the heart two ounces† of vitalized blood leave the lungs, to convey new life and vigour to the system; and two ounces, wanting in life-giving properties, enter the lungs for vitalization. Every two-and-a-half minutes the whole blood of the human body—amounting to between twenty and thirty pounds, *nearly three gallons*—passes over the respiratory surface, being conveyed in tubes so extremely minute, that the blood corpuscles—measuring less than the

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* Principles of Human Physiology, § 758.

† *About* two ounces. The reader will perceive that various numbers scattered through these pages are statements of *averages:* "heart," "lungs," and other general expressions will be seen to have reference to *man.*

30,000th of an inch in diameter, and totally invisible save under the influence of a very powerful microscope—must all pass through in single file. This fact alone is sufficient to show what myriads of these little channels must exist, and over how vast a surface they must extend.*

Let us now consider the *quantity of air* which is being daily presented to this surface. It will of course vary according to age, constitution, and mode of living. Dr. Southwood Smith thinks that the quantity received into the lungs, "at an inspiration easy, natural, and free from any great effort, may be two pints and a half;" but that "the quantity received at an ordinary inspiration, without any effort at all, is about one pint."† Now we will calculate from the lower of these data. The quantity of air received at an ordinary inspiration, without any effort at all, and when the body and mind are tranquil, is, according to Dr. Smith, about *one pint.* Considering eighteen respirations to take-place in one minute, about eighteen pints of pure air are necessary for sustaining healthful life during that short period. *One little minute of healthful life cannot be enjoyed without about eighteen pints of pure air being diffused over that wonderful extent of delicate capillary net-work which we just now contemplated.* The quantity requisite for an hour of health will thus be 1080 pints. And, to continue the calculation, during one day's healthful existence, 25,920 pints, or *no less than* 60 *hogsheads* of pure atmosphere must enter the lungs—and this is allowing but one pint for each inspiration, and but eighteen inspirations for each minute; though it must be clear to all, that during active exercise it frequently happens that in one minute of time more than twice eighteen inspirations take-place, and considerably more than a pint of air enters the lungs at a single inspiration.*

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* When, however, the lungs become congested or inflamed, probably three or four rows of corpuscles are admitted into the distended capillaries.

† Philosophy of Health, vol. ii. § 422.

Now, this immense volume of air is on purpose to give life to the liquid essence of our food—life to the *dead blood.* Until acted-upon by the atmosphere, the fluid which is traversing the lungs is, to all intents and purposes, dead; and, consequently, totally incapable of repairing worn structures, of carrying-on functions, or of maintaining any vitality in the system: nay, it even contains in its elements a considerable quantity of pernicious poison, brought to the lungs to be given out in the act of breathing, lest it should kill the human fabric. The poison alluded to is carbonic acid. To breathe in an atmosphere of carbonic acid is *death,* as rapid as it is certain.

The pure air inspired by the lungs contains 79 parts of nitrogen to 21 of oxygen; but the air *ex*pired is found, on being analyzed, to have lost about 5 out of the 21 parts of oxygen, or about *a fourth* of its oxygen—its place being supplied by an equal volume of carbonic acid. The other constituent, nitrogen, is scarcely altered. It should, then, be noted that with every effort of the lungs, a large proportion of the oxygen inhaled is taken-up by the system. It is this element of the atmosphere which kindles the fire of being. It is this which is momentarily busy within the breasts of us all, working-out the great human miracle. The instant the dark, rank, poisonous fluid which is circulating in the lungs receives within itself this vital air, swift as a flash it leaps instinct with life, as if touched by the spirit of the great Creator. Such is Nature's law. So wonderful are all the laws ordained to govern being. And well were it for man's happiness could he but be made to feel that *when he breaks a law of Nature, he breaks a law of God.*

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* See Appendix No. II. p. 58.

We are now prepared to reflect on the educational importance of ventilation. We have seen that about sixty hogsheads of air must enter the human lungs during one day's healthful existence. But we must not for a moment suppose, that if a human being were shut-up in an unventilated apartment, containing, upon his entry, sixty hogsheads, or even thrice sixty hogsheads of pure air, he might remain there with impunity the entire day. If no interchange were to take-place between the air within and the air without the apartment, severe functional derangement would ensue long before the expiration of the period. This is easy to comprehend.

Let us imagine forty individuals to have entered a room of sufficient size to receive them without overcrowding. We may as well consider it an ordinary school-room, and the forty individuals, forty industrious pupils. This will give us an opportunity of noticing, among other things, how impure air affects the thinking brain. Suppose them diligently at work, then, in an unventilated apartment, with the door and windows closed. Now, calculating from the same estimates as before, in one minute from the time of entry, each of the forty pairs of lungs has performed eighteen respirations; and with every respiration, a pint of air has been deprived of a fourth-part of its oxygen; and the same volume of carbonic acid has been mingled with the atmosphere of the school-room. In one minute of time, therefore, 40 times 18 pints, that is, seven-hundred-and-twenty pints,—as we are not speaking of adults, we will say *six hundred pints* of the enclosed air, have been deprived of no less than a fourth of their creative oxygen; while an equal volume of the destroying acid is floating in the apartment, and influencing the blood at every inspiration. Or (which will be found, upon calculation, to amount to the same thing), in one single minute, as much as *one-hundred-and-fifty* pints —upwards of *eighteen gallons** of air, have altogether lost their life-creating power; the deficiency being made-up by a deadly poison.

Now, since such a change takes-place in one minute, let me beg of you to reflect what change takes-place in ten,—what in twenty,—what in half-an-hour,—what must be the amount of poison which the lungs of these unfortunate victims are inhaling, after an hour of such confinement. And yet, how common it is, not for school children alone, but for persons of all ages and conditions, to be shut-up in low-pitched, badly-ventilated apartments, for more than five, six, or seven hours together. Allow me to remind you that in the human body the blood circulates once in 2½ minutes. In 2½ minutes, all the blood contained in the system traverses the respiratory surface. Every one, then, who breathes an impure atmosphere 2½ minutes, has every particle of his blood acted-on by the vitiating air. Every particle has become less vital —less capable of repairing structures, or of carrying-on functions: and the longer such air is respired, the more impure it becomes, and the more corrupted grows the blood. Permit me to repeat, that after breathing for 2½ minutes, an atmosphere incapable of properly oxygenating the fluids which are traversing the lungs, every drop of blood in the human being is more or less *poisoned;* and in 2½ minutes more, every the minutest part of all man's fine-wrought organs has been visited and acted-upon by this poisoned fluid—the tender, delicate eye, the wakeful ear, the sensitive nerves, the heart, the brain; together with the skin, the muscles, the bones throughout their structure, in short, the entire being. There is not a point in the human frame but has been traversed by vitiated blood—not a point but must have suffered injury.†

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* 18¾ gallons.

† In assuming, here and elsewhere, that the blood performs a round of

But to return to our industrious pupils. It is a well-known fact in physiology, that the vital fluid is always most busy among the most active organs. For instance, during digestion, there is an unusual flow of blood throughout the organs of nutrition; during muscular exertion, the flow is increased among the muscles; and when the mind is active, the circulation in the brain is augmented.

Now, with the forty inmates of the school-room, what are the organs chiefly called into activity? Evidently, the organs of the mind. The pupils are gathered together on purpose to exercise their brains. It is in the brain, then, of each that this poisoned blood is most busy. Every mental effort, in an atmosphere such as we suppose these victims to be inhaling, encourages the flow of poison to the brain. The greater their efforts to improve their powers, the greater the injury inflicted on their minds: for, in the words of Liebig, "every thought, every sensation, is accompanied by a change in the composition of the substance of the brain,"* and the brain, by thought consumed, is to be re-organized and invigorated by life-creating blood. Such are the laws of Nature; but if by breaking her laws we vitiate the blood, how can we expect the delicate brain, or any of our fine-worked organs, to be properly reared from a gross material? †

In reference to this school-room, it may be said,

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circulation in 2½ minutes, I adopt a common opinion. There seem, however, strong reasons for supposing that this estimate "is very much underrated" (*Carpenter's Human Physiology*, §§ 724, 725), and "that the whole mass of the blood is carried round the body in about a minute" (*Mr. Grainger's Report on Epidemic Cholera*, p. 92). But whatever the *ordinary* rapidity of the circulation, it should be borne in mind that under the influence of muscular exertion this rapidity is frequently doubled, and perhaps, at times, even *quadrupled*. It is probable that during a period of great bodily activity the whole of the blood traverses the respiratory surface in *thirty or forty seconds*.

* Liebig's Animal Chemistry, p. 9.

† As the development of the brain requires a greater amount of pure blood than any other organ of the system, so it suffers more than any other organ from the effects of impure air.

that the windows and door might stand open. At times they might undoubtedly, but (to say naught of the ill-effects of draughts) the weather will not always permit of this. Moreover, no kind of ventilation should be considered adequate, but that which allows carbonic acid to escape as regularly as it is formed. From the apartment where the forty quiet sufferers are exercising their brains, it is evident that there ought to pass out every minute all the carbonic acid formed by expiring six hundred pints of air; and an equal volume of oxygen ought, during the same time, to find an entrance. And this is without taking into the calculation a quantity of unwholesome watery vapour and animal effluvia constantly being exhaled from the lungs and skin; and which, in the case before us, would amount to several pounds in the course of three or four hours.*

We see, then, how essential to human education it is, that all apartments should be properly ventilated; and particularly those in which many are in the habit of assembling; and more especially where children assemble for mental cultivation. It has been shown in former lectures, that without due daily exercise and proper diet, sound health is impossible: yet neither food nor exercise is so essential to man's development as the air that he breathes. Without food or exercise, he may enjoy life some hours; he may live some days. He cannot exist a few minutes without air. And yet, what laws are so infringed as the laws of respiration? In our temples of public worship, in our courts of justice, in our prisons, our mines, our factories, and our schools, ventilation was, until lately, almost disregarded—nay, is still, in many places, *entirely* disregarded. And as for private dwellings, it may be most unhesitatingly affirmed, that even for the wealthier classes of society, not one house in a hundred —perhaps not one in a thousand—is constructed on sound sanitary principles with respect to its ventilation. I allude not so much to lower stories, as to dormitories. How rare to find a dormitory whose atmosphere at early morning would be no more tainted than when it was entered for repose the previous night. Yet, be it borne in mind, that whenever, after a night's repose, the slightest degree of closeness is perceptible in a chamber, it is an incontrovertible proof that the chamber is not well ventilated; and that whatever may have been the benefit which the system may have received from sleep, that benefit has been partly neutralized by the ill-effects of an impure atmosphere.

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* According to the *lowest* estimate of Lavoisier, 20 ounces of waste matter are exhaled from the human skin in 24 hours. This amount, therefore, would be exhaled from the perspiratory pores of 24 persons in 1 hour, being at the rate of 5 *pounds every* 4 *hours for* 24 *persons*. Under the influence of warm rooms this rate would be greatly increased.

Let us look at this more closely. It was just now explained that in one minute forty persons consume at least as much oxygen as would be contained in eighteen gallons of pure atmosphere; and emit, in the act of breathing, an amount of carbonic acid equal in volume to the oxygen consumed. Now, whether forty persons breathe in a confined atmosphere for one minute, or one person for forty minutes, the effect produced must be the same. One person, then, respiring a confined atmosphere forty minutes, or, if you like, two persons respiring a confined atmosphere twenty minutes, convert, as it were, the vital principle of no less than eighteen gallons of this atmosphere into a deadly poison. Eighteen gallons of air rendered injurious instead of life-giving by two persons in twenty minutes! fifty-four gallons so changed in an hour! eight times fifty-four gallons—*upwards of four-hundred-and-thirty gallons* *—of air not only deprived of all creative power, but absolutely poisoned, by two persons during a moderately long night's rest! Need anything more be said to show the importance of bed-room ventilation? Is it necessary to state that the sickening odours, so perceptible at the first of the morning in any ill-ventilated sleeping-apartment, arise from the fact that a considerable volume of carbonic acid, with the vapour of perspiration and other animal exhalations, are mingled with the atmosphere of the chamber? Science proves that all these products are deadly poisons. Nature expels them from the system, because they poison the system. Yet we insist on enclosing them within four walls. We shut-up doors, windows, and even chimney-places, that not a particle may escape. Nay, we surround our beds with close-drawn curtains for the express purpose, it would seem, of *preventing* ventilation—for the express purpose of hugging close the poisonous atmosphere of our own bodies, and so re-absorbing into our systems the very atoms which, by the laws of God, have been cast out because they are detrimental. That we do re-absorb these poisons, needs no proof. The same act of breathing which renders them perceptible to the sense of smell, causes them to visit every air-cell, to permeate every blood-vessel of the lungs, and come into positive contact with all the countless myriads of streams which are traversing the one–hundred–and–sixty-six square yards of respiratory surface. And so it is, that this wonderful surface, which God in his goodness has fashioned so delicately for the purification of the blood, man in his ignorance is constantly converting into a means of poisoning all the system's organs. Perhaps there is no more startling proof of the utter ignorance that exists concerning the laws of health, than is manifested in the construction of our houses. Halls, ante-rooms, dining-rooms, and drawing-rooms, which during a portion of the day are generally left empty—which may at any time be aired by the opening of windows, and which are constantly being ventilated by the opening and shutting of doors, or by draughts towards the chimney

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* More accurately, 18¾ × 3 × 8 = *four-hundred-and-fifty* gallons.

—these apartments are always the most spacious and airy; while bed-rooms, which are generally tenanted with closed doors and windows for eight or nine consecutive hours—where, therefore, the vitiation of the air must be very great, and where, in consequence, an ampler space for breathing is an important requisite—these are generally found the most airless rooms of a dwelling-house. Such errors could not possibly exist, were not the generality so utterly uninformed as regards that branch of knowledge which should be made the first consideration in every person's education—*a knowledge of the laws ordained by God for man's health and happiness.* I cannot but repeat, and earnestly beg of you to bear in mind, that no kind of ventilation should be considered good, but such as allows the regular escape of all the carbonic acid thrown out at every expiration, together with all the animal effluvia constantly being exhaled from the lungs and skin; and that no dormitory whatever, the morning air of which strikes the senses in any manner disagreeably, can be considered so thoroughly healthful as every dormitory ought to be.*

But if even *the rich* suffer in health through infringement of the law of respiration—if even *they* are rendered more liable to various ailments—if *their* sicknesses and sorrows are increased, their length of days diminished, through the ill-construction of their dwellings, what must we say of the condition of the poor, compared with many of whose homes it is no hyperbole to declare, the meanest dormitory in the house of a wealthy citizen is as a paradise?

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* "Nothing," says Sir James Clark (as quoted by Dr. Gavin), "can be constructed on a *worse principle* than bed-rooms generally are. Their small size and their lowness render them very insalubrious; the consequence is, we are breathing vitiated air during the greater part of the night; that is, during MORE THAN A THIRD PART OF OUR LIVES." Again, "The custom which prevails of surrounding beds with thick curtains is most injurious to health; and it is to this habit, and to the heated atmosphere of their bed-rooms, that the languor and bloated appearance of many young persons, on first awaking in the morning, are in a great measure to be attributed."—*Clark, on Consumption and Scrofula*, p. 280; and *The Habitations of the Industrious Classes by Hector Gavin, M.D. &c.*, p. 35.

For a larger insight into the vast importance of ventilating bed-rooms, &c., see Dr. Combe's valuable work on *Physical and Mental Education*, Chaps. X. and XI.

There is no apothegm more true than that "one half the world knows not how the other half lives." Happy will it be for England when her sympathies increase towards her poor. How much greater might this great country be, were there a stronger bond of amity between all her classes. How full of health, and industry, and peace, if one and all were anxious to augment, according to their means, the happiness of their fellow-creatures. What a saving of sorrow if the wealthier classes, instead of keeping aloof from the dwellings of the poor, were to search-out their haunts, enter their abodes, inspect their degraded state, and struggle for its removal.

The nation knows not the depth of its own misery. Would that it were in my power to paint this misery—to bring home to the hearts and understandings of the more generous among our people the condition of the wretched beings who tenant the innumerable huts and hovels which disgrace our country; or, worse, the condition of the hundreds of thousands who are compelled to herd together like mere animals—a whole family eating, drinking, sleeping, without regard to numbers, age, or sex, in one foul room; or, still worse, the condition of such outcast wretches as grovel together in fetid cellars, dark even at noon-day; but to comprehend these shames, they must be seen. Only, let it be understood that the people who lives thus loathsomely among us may be reckoned by hundreds of thousands. I speak advisedly when I say *hundreds of thousands.* There is probably not a town in the kingdom but where numerous instances may be found of a single narrow room being the entire home of a whole family; their only shelter, night and day; their kitchen, their scullery, their wash-room, their work-shop, their dormitory, their *all*. For the old, and young, and middle-aged, to be nightly crowded together, without distinction of sex, in one low garret, is too common among our labouring classes to affect their minds with any sense of shame. There is scarcely a country parish but might furnish proofs of this. It is, however, in the dark and narrow places of over-crowded towns that misery chiefly congregates, and humanity may be contemplated in its fullest degradation. In but *seven towns* belonging to one county, Lancashire, the inhabitants of cellar-dwellings were estimated, in 1848, at upwards of *sixty-seven thousands.* In Manchester alone there were upwards of *eighteen thousands*; and in Liverpool nearly FORTY THOUSANDS! Is this a fact to be heard and then forgotten? FORTY THOUSAND *fellow-creatures in one English town with nothing better to which they could apply the name of home than their portion in a damp, foul cellar!* and this but half-a-dozen years ago!* And as to the over-crowding in such places, innumerable are the reported instances of cellars, or room-tenements almost, if not quite, equalling cellars in point of foulness, being shared, each by *several* families. "It is no unusual circumstance," writes Mr. Rawlinson, "to find three, four, or five families—men, women, and children—huddled indiscriminately together in one apartment, which, even in a most

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* Cellar-population (1848).

Liverpool	39,460
Manchester	18,217
Preston	2,460
Wigan	276
Bury	615
Rochdale	1,747
Bolton	4,961
Total	67,736

"These cellars are in almost every instance undrained."—APPENDIX TO NOTIFICATION, *issued by the General Board of Health in* 1851 *concerning Cellar-Dwellings and Common Lodging-Houses; and consisting of Extracts from Reports collected by Dr. Lyon Playfair and Mr. Smith of Deanston*, p. 1 *et seq.*

airy locality, would be scarcely sufficient for the healthy existence" of a single family. "No one," he adds, "but persons who have visited such dens can form any idea of their horrible condition. Where there are beds, they touch each other, and generally occupy above three-fourths of the room; the space below them serving as coal-cellar and a depôt for every kind of filth. The ordinary rules of cleanliness and decency are set at nought; and, to augment the evil, these lodging-houses are generally in the most miserable and ill-ventilated yards, which, in their turn, contain ash-pits, pig-sties," and worse abominations, all "in a most loathsome condition." * Remember that these are reported as common occurrences; nor are they the worst that might be cited. Dr. Duncan, speaking of the cellars of several lodging-houses which he inspected, says, "at night their floors—often the bare earth—are covered with straw; and there the lodgers, all who can afford to pay a penny for the accommodation, arrange themselves as best they may, until scarcely a single available inch of space is left unoccupied; and in this way as many as thirty human beings or more are packed together, each inhaling the poison which his neighbour generates, and the whole presenting in miniature a picture of the black-hole of Calcutta." †

It is not too strong language to say, *this is the sort of life which we have for years* INSISTED *on our poor adopting*; for they have had no alternative—nay, have still no alternative but to choose between such homes or none. True we have an Act which might prohibit the use of cellar-dwellings,‡ and another for the well-ordering of common lodging-houses;§ but these, though highly valuable as far as they go, are utterly inadequate to meet this monster evil. Remember, that the efficient working of such Acts must ever depend upon the vigilance of local authorities, who are, for the most part, far too remiss in the performance of their duties: thus the Lodging-House Act "has in many towns been grievously neglected,"* while underground dormitories are as thronged as ever. Remember too, that as circumstances exist at present, the wielding the full powers of the law would only make bad matters worse; for where are the wretched multitudes to go, who would thus be driven from cellars and lodging-houses? Remember further, that the Lodging-House Act does not extend to the City of London, nor to Ireland, nor to any part of Scotland, where—especially at Edinburgh and Glasgow—filth and over-crowding exist to an extent almost incredible.†

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* APPENDIX TO NOTIFICATION, issued by, &c., p. 11. † Ibid. p. 5.

‡ Clause 67 of the Public Health Act, 11 & 12 Vict. cap. 63.

§ 14 & 15 Vict. cap. 28, and 16 & 17 Vict. cap. 41.

See, then, how disease is *forced* upon hundreds of thousands of the people. If there *be* dignity in labour,‡ see how that dignity is being befouled. If the poor *be* the bulwark of the nation, see how that bulwark is being undermined. If to them you look as your defence against aggression, to them when England's honour is assailed, to them when tyrants would trample-down the weak, to them when despotism would strangle liberty, then mark how you are sapping the foundations of your own strong towers, turning strength to feebleness, and vigour to decay.* And do not for a moment harbour the idea that these tales of wretchedness have been exaggerated. Believe me, it would be very difficult to o'erpaint the misery of your degraded thousands. You may gather, from most authentic sources, that many of their cellars have no light, no means of ventilation whatever—that many are inner cellars, supplied with no air but such as comes from the outer cellars—that in holes such as these, on the bare ground, or on damp and filthy straw, men, women, and little children are constantly allowed to lie and die—that those who have visited the sick and dying have had to cross the floors on bricks placed for the occasion, the cellars being flooded with stagnant waters†—that there are numerous ranges of cellars in which the beds are habitually raised on bricks to keep them from the water, which in rainy seasons "often rises above a foot in depth"—that most of these cellars are "fetid and foul with the worst kind of filth," and totally destitute of drainage—that numberless room-tenements which have been inspected are almost as bad as the cellars, and that in many respects the low lodging-houses are, or were in '51, far worse; in some of which it has not been unusual for thirty or forty persons to sleep on straw together, in a room but little more than twelve feet square; and these are put forward by witnesses as

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* Results of Sanitary Improvement, by Dr. Southwood Smith, p. 15.

† Though the common lodging-houses of the City are regulated under a Local Act—and much better regulated than those of many of our towns—still, there are no powers given under this, nor indeed under any Act, local or otherwise, to prevent its being a "common thing, in a room of twelve-feet square or less, to find three or four families *styed* together (perhaps with infectious disease among them), filling the same space night and day." "This pestilential heaping of human beings creates," as Mr. Simon informs us, "enough mortality to mask all sanitary progress within the City."—*Report for* 1849-50, p. 87. Of the "continually increasing over-crowding" in Glasgow, Dr. Sutherland says, "I am credibly informed that for years a population of many thousands has been annually added to the city by immigration, without a single house being built to receive them." These "go to swell the catalogue" of victims compelled to inhabit "those wretched dens of misery, disease, and death, *the low lodging-houses*."

The same writer's account of the labouring classes of Edinburgh is only equalled by his painful description of the "Wynds and Closes" of Glasgow.—(*Report of the General Board of Health on Epidemic Cholera*, p. 54, and *Dr. Sutherland's Report*, p. 74.)

‡ That very beautiful expression "the dignity of labour," first used by one of the Bishops of our Church, is not an expression likely to be forgotten. At present, however, it is, in the mouths of many, but a self-upbraiding sarcasm.

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* See Appendix No. III. p. 61.

† Mr. Holme, of Liverpool, in describing the state of cellars in that town, says, "Some time ago I visited a poor woman in distress, the wife of a labouring man; she had been confined only a few days, and herself and infant were lying on straw in a vault through the outer cellar, with a clay floor impervious to water. There was no light nor ventilation in it, and the air was dreadful. I had to walk on bricks across the floor to reach her bedside, as the floor itself was flooded with stagnant water. *This is by no means an extraordinary case.*"—APPENDIX TO NOTIFICATION, issued by, &c., p. 2.

common facts—specimens of every-day misery. "I could add," says Mr. Rawlinson, "proof upon proof, from personal inspection, of the misery endured by the outcast poor who crowd together in cellars or room-tenements, ruinous and totally unprovided with any means of ventilation." Room-tenements of this character he found common in all the northern towns which he officially visited—Morpeth, Alnwick, Berwick-upon-Tweed, Carlisle, Penrith, Ormskirk, Whitehaven, Sunderland, Gateshead, and Newcastle-upon-Tyne;* which has lately paid the penalty in *upwards of fifteen hundred deaths from cholera.* Dr. Playfair found room-tenements, cellars, and lodging-houses, all of the most loathsome description, abounding more or less in all the principal towns in Lancashire. Other witnesses speak of the state of things as equally deplorable in Tynemouth, Durham, Darlington, Hartlepool, Leeds, Halifax, Nantwich, Derby, Stoke-upon-Trent, New Sleaford, New Windsor, Rugby, Cardiff, and a score of towns besides.†

These facts were issued from the Health Office in 1851:‡ and though since that period the energies of a few enlightened men have undoubtedly effected much towards the removal of these shames, still, all that has been done is but as a drop to the ocean compared with what requires doing. In his Report on the working of the Lodging-House Act, Captain Hay has shown that a complete supervision of common lodging-houses must be a most laborious work. He has shown how, up to December '52, the inadequate agency employed had failed to grapple with the evil; but gives reason to hope that hereafter, with enlarged legal powers, the metropolis and the country may be freed from these sources of danger.§ In '53 the

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* APPENDIX TO NOTIFICATION, issued by, &c., p. 17.

† Ibid. *passim.*

‡ At which time it was stated that, "except, indeed, at Liverpool," matters "had been but little improved" since 1848. See Note, p. 27.

§ Report on the Operation of the Common Lodging-Houses Act, by Captain Hay, one of the Commissioners of Metropolitan Police (1852), p. 12. See, likewise, a Second Report (1854).

Act was amended; but it still requires amending. Its provisions must be augmented: its field of action extended throughout the kingdom. And hand in hand with the working of the Act must spring-up model-dwellings for the poor; not here and there, but in every spot requiring them:—some for artisans, others for labourers, others for the more degraded classes; but all of a wholesome kind, and in numbers adequate for the occasion. *Every parish should find healthful homes for those ejected from its over-crowded lodging-houses.* If some such scheme as this be not adopted, I warn you that by driving your myriads from garrets, vaults, and cellars, you are giving to cold-hearted speculators a direct encouragement to go on raising tenements of that unwholesome kind, which cannot but augment disease throughout the nation. Your outcasts must be sheltered somewhere: if the legislature do not insist upon their having healthful homes, huts and hovels will be everywhere erected, on a principle which will render health impossible. These, remember, are matters in which the poor cannot help themselves. While none but death-dwellings are raised for them, they are compelled to inhabit death-dwellings. If, then, the nation would cease to be guilty of the destruction of its own flesh and blood, there must be an Act to enforce the building of healthful poor-man's-homes.* But more than this—

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* It is by no means intended to argue that parishes should be called-upon to lay out large sums of money in housing the poor without the prospect of an adequate return. Speaking of the Metropolitan Society for Improving the Dwellings of the Industrious Classes, Dr. Southwood Smith says, "It was no part of the plan of the Association to attempt to assist the labouring classes by offering them any gift or charity, which, however it may 'bless' the giver, rarely benefits the recipients, but, on the contrary, tends to injure and corrupt them, by lessening their self-reliance and destroying their self-respect. The proposal of the Association was, "*that the industrious man should pay the full value of his house; but that for the sum he pays he should possess a salubrious and commodious dwelling, instead of one in which cleanliness, comfort, and health can have no place.*"—(*Results of Sanitary Improvement*, p. 5.) A similar object should be entertained in every parish throughout the kingdom; and if all local authorities were actuated by the same spirit which actuated the founders of the above-mentioned association, they would find power given them under the "Labouring Classes' Lodging-

much more—is requisite, before filth and over-crowding can be abolished. The Building Act must be remodelled: selfish men must no longer be *permitted* to erect whole streets of disease. The Public Health Act must be amended, extended, and made *compulsory* :[*] our most ignorant towns require it most, yet by these it is most commonly rejected. And more than all, the hands of the Board of Health must be strengthened. While drains and sewers are under the supervision of one party, water-supply under the control of another, power of removing nuisances vested in a third, and so on,—how is it possible to proceed with the physical education of the country? A Board of Health should be what its name indicates. *It should be vested with adequate control over every evil known to be detrimental to the public health.* It may be a long time first, but it must come to this at last; and the sooner the better for all classes of society. People hear of Baths and Wash-houses, and Model Lodging-Houses, and Health Acts, and Lodging-House Acts, and a host besides, and fancy everything going on quite well and rapidly; and when you speak in their presence of the frightful condition of the poor, they are apt to return, '*O but this isn't so now: the legislature has interfered.*' To such my reply is, *Examine for yourselves.* It needs but inspection to prove that tenements for the poor, if not absolutely as bad as

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Houses Act,"[†] to do for the poor, at all events a large portion of what the poor have a right to expect, and at the same time improve the condition of town populations generally. But since, through apathy or some worse cause, this Act (which *permits*, but does not *enforce*) is, as far as ninety-nine parishes out of a hundred are concerned, a mere dead letter, it is surely due to the classes for whose benefit it was intended, that its clauses should be made to bear a more stringent character.

[*] The passing of the Scotch Police and Improvement Act was made the plea for not extending the Public Health Act beyond the Tweed. But this Scotch Act (which is simply *permissive* in character) "*has been adopted by hardly any towns in Scotland*" (*Report on the Administration of the Public Health Act*, p. 35). What is required is an efficient and workable Health Act *for the kingdom*.

[†] 14 & 15 Vict. cap. 34.

some which we have been noticing, still of a kind which must be regarded as nothing less than a national disgrace, abound in every county of the kingdom.*

Now, look near home. How fare the poor of this metropolis? We will not care to scrutinize the loathsome condition of St. Giles's, Agar Town, the Potteries, and other well-known localities of our worst-conditioned poor. Avoiding extreme cases, let us take the labouring population generally. How, then, stand the facts as regards London?

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* While these pages are passing through the press, a Bill for the continuance of a somewhat re-constructed Board of Health will probably be undergoing Parliamentary discussion. That, in the present state of public opinion on the subject, the Bill brought forward will be what it ought to be, or that, in case it were what it ought to be, the legislative body would consent to its passing into a law, is not, alas! for one moment to be expected. What should comprise within itself the considerations of grander reforms than have ever yet entered into the minds of nations to conceive, will be circumscribed to some little measure suitable to the lukewarmness and apathy with which it will be regarded. Matters that should involve the questions of health, strength, and happiness to millions—the physical development of an entire mighty nation—will be scarcely considered worthy of a thought from Government or of the attention of the popular assembly. Few members will care to speak upon 'a mere bill of health.' If one or two venture to express enlarged views thereon, it will be with a feeble fear that they are going too far; while two or three others, may be, will oppose the word "centralization," and talk of such and such ideas as "unconstitutional;" and so the little measure will either be rejected or pass into law, according as party feeling or fear of plague happens to be the stronger for the time being. It is hard to conceive anything more lamentable than the narrowness of mind and lack of moral courage constantly exhibited on such occasions, in an assembly which should shine-forth to nations as a pattern of all that is truly noble in human nature. There is no one moral man in the kingdom who, having it in his power to save, would for a moment hesitate to stretch-forth his hand to prevent a *slaughter* or a *suicide*; to talk, then, of its being "unconstitutional" to rescue thousands from such untimely ends, is a sad mark of something wanting either in the mind or in the heart. With regard to those who advance opinions that a Central Board of Health is no longer requisite (and there are such men even among the Members of the House of Commons), the most charitable construction to put upon their conduct is to suppose that they have never bestowed upon the matter one serious thought. "All sanitary arrangements are still kept so imperfect (throughout our towns) that no improvement sensibly affecting the rate of mortality has hitherto been effected;"† but if one question of social reform more than any other demands the immediate and earnest attention of the Government and the entire legislature, it is *how to improve the dwellings of the industrious poor.*—(June, 1854.)

† Return of Marriages, Births, and Deaths for the Quarter ending June, 1852, published by authority of the Registrar-General.

From evidence laid before Parliament, it appears that of all the deaths which take-place in the metropolis, "upwards of one half are of the labouring classes;" and further, "that of these, four out of five occur in families that have only one living and sleeping room." Now, the annual deaths for London may be estimated at 52,000, of which upwards of six-and-twenty thousands are of the labouring population. Upwards of 20,000 of these deaths, therefore, occur in families possessing but "one living and sleeping room; that is to say, in upwards of 20,000 instances, every year, the corpse must be kept, during the interval between the death and the interment, in the same room in which the surviving members of the family live and sleep."*

Now, how is it possible to over-estimate this evil? TWENTY THOUSAND *instances of whole families compelled to pass a considerable portion of several consecutive days, huddled together in close companionship with a corpse!* And this is happening in London yearly. Whatever the cause of death, there is no help for them. If arising from scarlet fever or malignant typhus, there is no help for them. If from confluent smallpox, still there is no help. If, through want of means to defray the funeral expenses, the putrid remains are kept above ground for more than a fortnight, as is frequently the case, yet they must endure. They must eat, and drink, and work, and sleep, in the presence of loathsome death, which, may be, occupies their only bed. And this is no "dispensation of Providence,"—no "curse" affixed on special sin. However sober and industrious, however morally inclined the family may be, however anxious to obey the laws of God and man, still there is no help; but with every breath they must inhale the vapour of contagion: and even though some members of the family escape the almost inevitable consequences, yet must they frequently behold those dear to them—those who, through grief and anxiety, through watching and nursing, and showing their love, have rendered themselves less able to resist the poison—sickening with the same disease which has already taken away a sister, a parent, or a brother. These are not fancies, but every-day occurrences. Proof upon proof might be advanced of death following death in the same family under circumstances here described. First, may be, an infant dies: then the mother; then, perhaps, another child; then the father; leaving not unfrequently two or three orphans for the Union. And for all this there is no help: it is their punishment for being poor. So much for the dwellings, not of the mere dregs of London's people—not of its vagrants, and pickpockets, and utterly abandoned—but of its "labouring population:" and yet bear in mind that London, for the number of its inhabitants, is not nearly so full of poverty as many of our towns, nor are its poor so densely crowded.* Thus, then, are *hundreds of thousands* of our labouring classes compelled to live and die throughout the country. Even in apartments most spacious and airy, the huddling together with the sick, the dying, and the decaying dead, would, as you know, be attended with extreme peril, though every other law of health were strictly observed. Can we wonder, then, that fevers and pestilences so scourge the poor, who, over-worked and ill-fed, endure what they endure, in low-roofed rooms, in localities undrained, unwatered, and often so foul with the worst kind of filth, that, at the very time when families are suffering from diseases chiefly caused by imperfect ventilation, they are compelled to close their doors and windows, to *keep out* the putrid air? Yes, when the cholera of

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* Report (from the Health Office) on a General Scheme for Extramural Sepulture, p. 106.

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* See Appendix No. IV. p. 63

'49 was at its height, and when those engaged in house to house visitation were endeavouring to impress upon the afflicted classes the importance of admitting air into their dwellings, again and again did the poor return, *They were obliged to keep their windows closed, the stench without was so intolerable.*[*]

And this brings us to a part of our subject of even more importance than any yet considered—*the uncleansed state of the country.* The country at large must be freed from its impurities before its people can obey the laws of health. Ventilation is worse than in vain, in a poisoned neighbourhood. While open sewers, choked drains, the refuse of towns and villages, putrid burial-grounds, and giant Smithfield evils, are allowed everywhere to abound, like hotbeds formed for the rearing of typhus, and cholera, and other earth-nursed terrors, which have of late been stalking through the world, as if to arouse mankind to the study of nature's beautiful ordinances,—while such evils exist, while the rank gases arising from such vilenesses are permitted to enter the delicate lungs, formed but to receive the pure atmosphere of heaven, let individuals be as careful as they may, the laws of respiration *must* be broken, and man's physical, intellectual, and moral development *must* be more or less retarded. If the fearful cholera-plague now hovering o'er the land, do but awaken the minds of the people to a knowledge of this truth, it will prove itself to be—what it doubtless is—a blessing in disguise, a saviour-of-life to millions in time to come, and a mighty promoter of man's education.[†]

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[*] "Cannot open his window on account of the nuisances below"—"could not keep their windows open on account of the horrid stench that emanates from the street"—"obliged to shut their windows for days together"—"not a window facing the yard could be opened," &c., &c. Reports teem with like expressions.

[†] Since the first issue of this pamphlet, the prognostications of those who were called alarmists have been sadly realized. The epidemic, as the reader well knows, has again scourged the country. Owing to

Let us give this matter our most serious consideration. And we must not look upon it as a poor man's question. Too true it is, that wherever there is a fetid ditch, a stagnant canal, a rank exposure of malarious mud, an assemblage of offensive trades, a spot more than usually ill-drained—wherever, in a word, there is, in the midst of a town, any ground to be built-on, which, on account of the vileness of the neighbourhood, may be purchased at a sufficiently low rate to warrant the speculation, there, as a constant consequence, will be found the dwellings of the poor. Still, this is not merely a poor man's question, but one which more or less affects the health and happiness of the entire nation. I trust to be able to explain most clearly, that there is not a single individual throughout the country but is personally interested in this important matter. As regards exercise, diet, cleanliness, clothing, and the like, all, save the poor, are in a great degree their own masters. They may keep or transgress the laws of health in these respects, and benefit or injure themselves accordingly. But it is not so with respiration. Wherever a man goes, he must breathe the air with

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the want of a more liberal Registration Act, the amount of valuable life thus snatched from the United Kingdom can never be fully known; but the last Quarterly Report from the General Register Office informs us (p. 41) that in the short space of *three months* of the year which has just closed upon us—the months of July, August, and September—*there perished in England and Wales alone, through diarrhœa and cholera,* 26,722 *persons!*

Never, perhaps, did the country need strong men more than at the present time. Will it take warning? Will it allow the cholera to prove itself, as far as the British Empire is concerned, a *blessing*. It is an indisputable fact, that if sound sanitary measures were pushed with energy throughout the kingdom, not only would some hundreds of thousands of lives be saved in the course of *twenty years*, but the general manhood of the nation would be more hardy, more intellectual, more energetic, more capable in every way of pursuing the paths of industry and peaceful enterprise, or of *fighting the country's battles*. If (which Heaven forbid), the terrible war be destined to be a long-protracted one, how much of England's ultimate success or failure in distant lands, may depend upon whether she does or does not, during the struggle, perform her duty to her people here at home! See Note, p. 54; and Appendix III. p. 61.—(*January*, 1855.)

which he is surrounded; and physiology proves it to be utterly impossible for any one to inspire an atmosphere containing poisons in suspension, without, in two or three minutes, poisoning every particle of his blood. But let us look to facts for arguments.

What are the gases evolved from the removable putridities of our country? Chiefly these: carburetted hydrogen, phosphuretted hydrogen, cyanogen, carbonic acid, and sulphuretted hydrogen, all of which are more or less injurious to health; but the most fatal, and at the same time the most copiously produced, are *carbonic acid* and *sulphuretted hydrogen.*

To inhale carbonic acid is death. This is too well known to require a comment. A mouse or bird placed in a reservoir of this gas instantly falls lifeless. Sulphuretted hydrogen is even more powerful in its action. In a very short time 1-1500th of this gas, mingled with the atmosphere, destroys a bird; 1-800th destroys a dog; and 1-250th suffices to kill a horse. All this has again and again been proved.

Carbonic acid is generated in church-vaults, grave-yards, slaughter-houses, and wherever putrid animal matter abounds; sulphuretted hydrogen, in ill-constructed sewers, drains, cesspools, &c. In what state of concentration these and other gases are generated in such places, the relation of a few facts will show; and first, of grave-yard gases:—

A man by the name of Jackson was digging a grave in Russell Court, Drury Lane. He struck into a recently-buried coffin. In an instant the poor fellow was rendered powerless. He was immediately dragged from the grave, but died in a few hours.

Water had penetrated into a tomb in the Eastern Cemetery. Two grave-diggers were employed to remove the dead. During their work they agitated the water. One man instantly fell lifeless. His comrade fell while attempting to raise him. They were quickly dragged from the tomb. One was dead. The other, notwithstanding the unremitting attention of two medical men, remained, for six hours, unconscious.

A grave had been dug in St. Botolph's church-yard, Aldgate. Subsequently two grave-diggers descended into it. They fell dead instantly.

A grave-digger, named Green, while employed in the church-yard of St. Margaret's, Westminster, was seen to fall. He was conveyed to the hospital, received all due care, but died in a few days. His medical attendant was similarly affected, and died four days after the grave-digger. The servant of the medical man was seized the day following her master's death : in a few days she was a corpse.

Cases of this description might be greatly multiplied ; but these are enough for our purpose. They are to be found, others among, in Mr. Walker's well-known works on the grave-yards of London ;* and the Board of Health, in their Report on a Scheme for Extramural Sepulture, not only bear ample testimony to the greatness of the evils exposed through the zeal of this gentleman, but show that "as far as examination has yet proceeded," the burial-places of country towns are, to say the least, in a condition equally dangerous with those of this metropolis. "We have hitherto," say the Board, "met with no single instance in which the care and management of these places of interment are in any respect superior."†

And now of sewer-gases. In October 1849, the cleansing of a certain sewer in Kenilworth Street, Pimlico, was resolved-on. Three men entered to commence their underground work. They did not re-appear as expected. An opening was made to search for them. Through this they were seen lying at the bottom of the sewer. With a hope to save, Mr. Wells, a surgeon, entered, followed by a constable named Walsh, and Richard Sherwan, a labourer. In two minutes Walsh returned and deposited the dead body of Mr. Wells. He had been killed in an instant. Walsh immediately re-entered the sewer, and again emerged, bringing back Sherwan in a lifeless state. On venturing a third time, Walsh fell dead. "Nothing," says the *Times* (from which this account is taken), "could exceed the virulence of the poison thus encountered. Not only were the sufferers struck-down as if by lightning, but their bodies were turned perfectly blue, as if coated with lead; and every piece of metal about their persons was stained a deep black."*

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* "*Grave-Yards of London,*" "*Interment and Disinterment,*" "*Gatherings from Grave-Yards,*" "*Lectures on Grave-Yards,*" &c.

† "As far as the examination has yet proceeded, the evidence shows that the condition of burial-grounds in country towns is *even worse* than it is in the metropolis ; and we have hitherto met with no single instance in which the care and management of these places of interment are in any respect superior."—*Report on a General Scheme for Extramural Sepulture*, p. 36.

About a fortnight previously to this occurrence, a sewer in Friar Street blew-up.† "The shock of the explosion was felt at a considerable distance. The cast-iron plates covering the man-holes along the flag-pavement were all blown into the air, and flames came through the gully-gratings into the street."‡ At the time of the accident cholera was raging immediately around the spot.

With the water of this sewer, Dr. Hassall tried certain experiments. He placed a fish in a vessel containing the liquid. It struggled violently, turned-over, and would have perished in a few seconds had it not been removed to a purer reservoir. He placed a bird in a glass bell-jar, into which the gas evolved by the sewer-water was allowed to pass. After showing strong symptoms of distress, it suddenly fell on its side, and, although immediately removed into fresh air, was found to be dead. These experiments were repeated with the water of six other sewers on the

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* *Times*, October 17, 1849.

† Friar Street, Blackfriars Road.

‡ *Times*, October 1, 1849.

Middlesex side of the river, and with pretty well the same results in every instance;[*] and were all the sewers throughout the kingdom to be similarly tested, it is beyond question that those of a very large majority of our towns would be found as pregnant with destruction as these which we have been noticing; while hundreds of thousands of the cesspools would, upon examination, be discovered to contain, impossible as it may appear, death-vapours of even more malignant intensity than those which struck-down the men in Pimlico.

So much, then, as to the *concentration* of poisons: let us now look a little to the *volume* generated.

We will still keep to London as our field of observation; bearing in mind, however, that London is but a gigantic specimen, and by no means the most fatal either, of the way in which the nation lays-down its forcing-beds for disease.

Dr. Playfair estimates the amount of gases annually evolved from the decomposition of 1117 corpses per acre, at "not less than 55,261 cubic feet."[†] Now, since about 52,000 burials have, during a lengthened series of years, been taking-place annually in the metropolis, it follows from this ratio that *at least two million, five–hundred–and–seventy-two thousand, five–hundred–and–eighty cubic feet* of gases have for many years been yearly emitted, and, what is worse, must for years to come be yearly emitted, from the metropolitan grave-yards!

The drains, sewers, and cesspools of London constitute what may well be termed an underground city of filth; and so constructed that probably three-fourths of the entire refuse of the metropolis are constantly steaming beneath the feet of its inhabitants:[*] the remaining fourth is sent out to pollute the Thames. Some notion may be formed of the size of this underground city, when we consider that it constitutes "an evaporating surface which might be represented by a canal thirty feet wide and forty miles long;"[†] or it may be said to be equal to 145½ acres of sewer, or cesspool surface, gathered together in the heart of London.[‡] It would be extremely difficult to calculate the amount of poison arising from this vast area of putridity;[§] but surely we are very far below the mark

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[*] Report by the General Board of Health on the Supply of Water to the Metropolis:—Appendix No. III. p. 41.

[†] Report (from the Health Office) on a General Scheme for Extramural Sepulture, p. 7.

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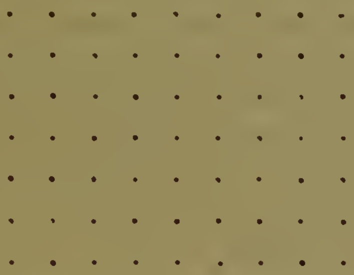
[*] When fever was raging "in the Cloisters of Westminster," it was determined to look to the drains, &c.:—"*One-hundred-and-fifty loads* of night-soil were taken out of the cesspools belonging to fifteen houses attacked by the epidemic, and *upwards of four hundred loads of refuse* from the drains and sewers connected with them!"—*Report by the General Board of Health on the Supply of Water to the Metropolis*, p. 176.

[†] Ibid. p. 181.

[‡] 40 miles × 30 feet = 145½ acres.

[§] which, vast as it is, appears to the writer to be very much understated. The number of cesspools existing merely within the square mile of the City of London was estimated, by the City Surveyor, in 1849, at *five-thousand-four-hundred-and-fourteen* (Mr. Simon's Report, p. 35). Were all these arranged equidistantly as follows—



the cesspools in each row, would be less than four-and-twenty yards apart; and every cesspool not in an outward row, would have *four other cesspools within twenty-four yards of it*, and *eight within thirty-six yards*. In addition to these *five-thousand-four-hundred-and-fourteen* cesspools (or whatever the present number may be), there are within the City about "fifty miles" of sewers, and probably upwards of one hundred miles of house-drains, both sewers and drains being, in many instances, constructed upon most injurious principles, and opening into the streets by means of countless gully-holes.

But deeply alarming as such a picture undoubtedly is, the square mile under consideration must be regarded as a *very favourable* specimen, as to underground arrangements, of *eight* or *ten* out of the twenty or thirty square miles generally figured-forth as "The Map of London:" other square miles belonging to the map are almost as densely when we estimate it at thrice the volume arising from the grave-yards: yet, even from this low estimate, it would appear that no less than *ten million, two-hundred-and-ninety thousand, three-hundred-and-twenty cubic feet* of gases are evolved every year from the sewerage, cesspools, and burial-grounds of London. We need, I think, go no further. Calculating nothing for stagnant canals, and countless reservoirs of offensive water; nothing for the many acres of Thames mud exposed at every retreating tide; nothing for its grossly-polluted stream;† nothing for cattle-markets and slaughter-houses, with their accompanying nuisances; nothing for the vast variety of offensive trades which necessitate the usage of putrid materials; nothing for thousands of ash-pits, pig-sties, poultry-yards, cow-sheds, and manure-heaps; nothing for such neighbourhoods as are totally destitute of drains, sewers, cess-

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packed with latent nuisances; while throughout the entire metropolitan range there is undoubtedly not a single district, perhaps not a single street, but where enormous aggregations of sewer or cesspool matter are reeking within a few feet of the surface of the soil.*

† Those who would form an idea of the amount of preventable poison arising from the Thames, are referred to Mr. Simon's Report (1852-3) on the Sanitary Condition of the City of London, p. 21, *et seq.*, and to the calculations of Mr. Glaisher, of the Royal Observatory, Greenwich, inserted in the Report (from the General Register Office) on Cholera in England. p. lix.—From these it seems indisputable that the vapour arising yearly between the bridges, where the river is increasing in foulness year by year, would, if condensed, equal *considerably more than* TWO-HUNDRED-AND-FORTY-FOUR *million cubic feet of water, in which Dr. Hassall has never failed to find that deadly poison, sulphuretted hydrogen.* He has detected it "*even after filtration.*"—See *Report on the Water Supply*, Appendix III. p. 50.

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* Since '49, and especially during the last twelve months, while little of value has been effected for the rest of the metropolis, the sanitary improvement of the City has been conducted with great energy. The cesspool system in particular has been "almost abolished," and though many of the City districts still are, and must for years remain, in a most deplorable condition, the enlightened liberality which has been displayed, has already met with a noble reward:—"Less suffering in the City of 1854 than in the City of 1849, less in the City clean than in the City dirty, less in the City cared for than in the Metropolis neglected." . . "Our cholera deaths of 1849 amounted to 728; on which our recent mortality of 211 (since the population is nearly fixed), shows *a reduction of* 71 *per cent.* In the former epidemic we contributed to the metropolitan mortality almost one-twentieth of its total; we have on this occasion contributed LESS THAN ONE FIFTIETH."—*Mr. Simon's Report on the Epidemic Cholera of* 1854, *as it prevailed in the City of London*, pp. 4 and 9.

pools, and conveniences of every kind, and where, as a natural consequence, the soil must be highly saturated with constantly-evolving poisons: calculating nothing for these and many other impediments to the observance of the laws of respiration, but only taking into consideration the emanations from our grave-yards and our underground city of filth, we find that from these two sources alone are annually generated, at the very lowest estimate, TEN MILLION, TWO-HUNDRED-AND-NINETY THOUSAND, THREE-HUNDRED-AND-TWENTY CUBIC FEET of deadly poison. ".Whatever portion of these gases is not absorbed by the earth—earth already surcharged with the accumulations of centuries—and whatever part does not mix with and contaminate the water, must be emitted 'into the atmosphere"* respired by the inhabitants of London.

Now, reflecting on the intensity of these poisons—killing, as they do, with the rapidity of a lightning-stroke—and on the whole vast volume generated, of which the volume named is but a small proportion, it might naturally be asked, How is it that plague is ever absent from the metropolis? why is it not constantly raging around our grave-yards and open sewers? how happens it that in London preventable disease destroys no more than twelve or fourteen thousands yearly? You tell us, it might be urged, that the poisons most copiously generated are of such power that 1-1500th only, mingled with the atmosphere, is quickly destructive of animal life: how is it, then, that we do not see our fellow-creatures dropping on all sides around us? A few words on the laws of gases will explain the reason.

It is a law in Nature that all aëriform bodies should rapidly diffuse through each other's masses. For instance, if a portion of hydrogen, the lightest known ponderable substance, be confined in a strong phial, and a portion of oxygen, which is sixteen times heavier, be confined in a similar vessel, and the two be connected by a narrow tube three or four feet long, the light hydrogen being placed above, the heavier oxygen below, in the course of a short time the heavier air will, in apparent contradiction to the law of gravity, be drawn-up by the lighter, and the lighter drawn-down by the heavier, so that an equal mixture of the two will be found in either phial; and the same property belongs to all gases.*

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* *Report (from the Health Office) on a General Scheme for Extramural Sepulture*, p. 50.—The words in the report have reference to grave-yard gases, but are equally applicable to poisons from cesspools, &c.

Here, then, we see the reason why people are not constantly falling dead in the vicinity of sewers and grave-yards. This law of diffusion, founded, like every other of God's laws, in wisdom, love, and justice, is hourly saving thousands of lives throughout the country—millions throughout the world. The noxious gases formed so rapidly in the various plague-spots of the metropolis, are with little less rapidity spread throughout its entire area. Were it not for this beautiful law, it would be certain death to approach a London church-yard, or to venture into any ill-drained district. But while we see how God thus careth for his creatures, we surely see how it behoves us to struggle for ourselves. The laws of Nature are all on man's side; but if, contrary to the reason which God gives him as his guide, man *will* surround himself with perils, would it be compatible with justice for God to save? Such as will not help themselves, must not look for special miracles. Man must work for himself as God works for him, and not make the Father's love an excuse for his own remissness. In the fetid localities of the poor, where, through our neglect, poisons are most strongly concentrated, there, as a natural consequence, fever and death are ever the most busy. This of itself should induce us all to work. But the very fact of their not being more busy than they are, proves that the question before us is no less than NATIONAL. *Thousands of the London poor are daily saved, because the poisons generated about their homes are rapidly spread through the surrounding atmosphere: "and though they thereby become diluted, and are thus rendered proportionally innocuous, yet that they do contribute to the contamination of the air" breathed by every member of the metropolis, from the Queen on her throne to the beggar in his cellar, is a truth as indubitable as the best established fact in natural philosophy.*

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* Daniell's Chemical Philosophy, § 98.

Why in your families do you see such pallid faces? Why even in your healthiest districts is the rose of health unknown? Why do you rarely behold in your town-nursed children that gushing overflow of life, so beautiful to notice in the innocent, healthy, happy young? I address myself to anxious and judicious parents. You have taken care that your children should constantly obey the laws of exercise and diet; you have clothed them judiciously; you have thought on the importance of cleanliness; you have sent them early to rest, have taught them to rise early, have ventilated their dormitories and school-rooms, and in every way have studied their health and happiness. Then, why are they so pale? why so easily affected by morbific influences? why so liable to head-aches, stomach-pains, and other causes of unhappiness? Look for your answer to the atmosphere. Look to the various plague-spots of the metropolis. Look to the neighbourhoods inhabited by your poor. Think that God is *just*, as well as wise and loving; and will not have his poor the only sufferers, but bids his laws to spread the poisons generated in vile districts, even into parks and palaces. Look, then, to your atmosphere for the cause of pallid faces. Think of the foggy vapours constantly arising from this vast ill-drained, cesspool'd area. Think that every particle of floating moisture is capable of holding in suspension many times its own volume of gaseous poison, and see the cause of paleness and general debility in the forced infringement of the law of respiration. And do not say within your minds, "This is an evil of necessity." True it is, that populous places have always been unhealthy ; true, that there are scores of localities throughout the kingdom in a still worse state than this metropolis: but is error to flourish for ever? Remember, it has yet to be solved whether towns may not be rendered even more salubrious than the country. This may sound strangely in your ears ; but ask yourselves, Has not God made man a social creature? Is it not clearly more to the advantage of the human race that they should live together in large bodies? Is it not clearly God's *intention* that they should thus live? Can we, then, imagine that what is clearly intended by God should be of necessity detrimental to man's health? Arguing from His attributes of wisdom, love, and justice, this cannot be ; and science is day by day tending to out-root the old idea.

The fact is, *Man is at present living contrary to the dictates of reason.* He must cease to live by brutish instinct. He must bear in mind that reason is the gift of God—the gift which should raise him *above* the brutes ; and he must use this gift for his own salvation. Then will he see Christianity in a better, broader light, and see the value of working, each for the good of all. When all grow more unanimous in well-doing ; when private interests give way to public benefits, and cattle-markets and all occupations causing unwholesome effluvia are removed to thinly-peopled districts ; when our towns are cleansed by a perfect system of drains and sewers ; when our dead are more Christianly disposed-of, and no depositories of filth permitted among a crowded population ; when streets are constructed with a surface which, though safe for traffic, shall be impenetrable to moisture, and therefore capable of being "daily washed and dried again as effectively and rapidly as a marble hall,"* when, for this and other healthful purposes, a constant supply of pure water "be borne along every thoroughfare and introduced into every dwelling,"† when the houses of both rich and poor be erected on sound sanitary principles—in fine, when all the powers of science and industry be applied to the improvement of towns and cities, then, and not till then, will the world be able to know whether the great emporiums of her commerce and manufactures may not rival in point of salubrity, I will not say the rural districts as they *now* exist, but the rural districts as they *may* exist when *they* likewise, in the course of reason, shall be greatly improved in healthfulness by the drainage of marshes, the recovery of bogs and swamps, and the diminution of all removable nuisances.‡

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* Mr. Grainger. † Idem.

‡ That our towns may 'rival, if not exceed, that high standard of health which man has been wont to regard as the exclusive blessing of rural districts,' to the thinking mind there can be no doubt; but before this can be proved *practically*, the people at large, and especially the poor, must become more enlightened with respect to the laws of being; and before the due enlightenment can take place, schools must greatly increase, and important reforms be effected in the training systems of *all* classes of society. Speaking of London, Mr. Simon says, "few competent persons will doubt that its mortality might *speedily* be reduced to the level of any district-mortality yet recorded by the Registrar-General" (*Report for* 1849-50, p. 11); and the exceedingly low death-rate returned by the Establishments of the Association for Improving the Dwellings of the Industrious Classes, shows the correctness of such views. How mournful to think that in the face of all this, our towns are getting more and more unhealthy; that deaths in towns are now "out of the same population, ONE-THIRD PART more numerous than the deaths in the surrounding country;" and that in London, which should stand as a model to the world, there were registered in the very last quarter concerning which returns have been made (and which was not so fatal a quarter as usual, speaking generally) *a greater number of deaths* "*than in any of four corresponding quarters* (1850-53)." §

For valuable opinions on these matters, see "*A Lecture on Unhealthfulness of Towns: its Causes and Remedies*," and "*A Report on the Present State of Certain Parts of the Metropolis*," both *by R. D. Grainger, Esq.*; also "*Results of Sanitary Improvement, by Southwood Smith, M.D.*"

§ Return of Marriages, Births, and Deaths, for the Quarter ending March, 1854, published by authority of the Registrar-General.—(From returns published since the first issue of this pamphlet, we learn that the deaths in London, But enough has been said on this great subject to show that the cleansing of the country and the caring for the poor are matters of the utmost moment to us all. The world, as it advances, will see more and more clearly how closely the interests of each division of society are united with the interests of all besides; and how each class must better its own condition by a successful striving for the good of the generality. Although this is in all things evident to every thinking mind, yet perhaps it is in nothing so distinctly demonstrable as in a contemplation of the vast importance of obedience to the law of respiration in connexion with the remembrance that it will be scarcely practicable for any one, whatever be his pains-taking, to constantly observe this law, *until the entire people of our towns dwell in pure localities.* It is seeing the difficulty of observing this law, yet knowing the utter impossibility of breathing, even for a few minutes, an atmosphere incapable of properly oxygenating the vital fluid without more or less injuring the entire system—this it is which causes me most unhesitatingly to pronounce the cleansing of the country as the greatest educational question of the day. To purify the atmosphere for a nation, is to purify a nation's blood; and to purify a nation's blood is to improve the entire nation physically, intellectually, and morally.

For the sake, then, of ourselves and others, bear we well in mind the truths which science has revealed; and bear we in mind that it is in each one's power to expedite such improvements as these revelations naturally suggest. The world moves exactly in accordance with the growth of public opinion, and the growth of public opinion must yet awhile be slow.

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during April, May, and June last, were "*in excess even of those in the unhealthy spring of* 1853;" and that the number registered for the metropolis during July, August, and September, amounted to no less than 11,952 *more* than were registered in the corresponding months of the previous year. The increased mortality during this latter quarter, arose mainly from cholera.—*January*, 1855.)

Still, there is no one possessed of an important truth but may scatter the seeds of truth abroad, and ever from such scatterings will sound opinions spring. And thus it is, that even the most humble individual among us is gifted with the power of contributing his mite to the benefit of the human family.

Our evening's reflections may now be brought to a close. We have reflected on the marvellous delicacy of those organs so tenderly shielded in the human breast; we have reflected on the wonderful extent of surface which they are constantly presenting to the action of the air; we have reflected on the extreme tenuity of the capillary net-work woven over this vast surface; we have reflected that through this delicate net-work the human blood is ever flowing—that at least one half-pound of blood is ever present there, and that two or three gallons pass through in two or three minutes; we have reflected on the change destined to take-place in the blood during its passage through these wonderful organs—that it enters the lungs dark and laden with poison, but leaves the lungs bright and full of life, which life, pulsating on, is conveyed in myriads of rushing streams to revivify every ultimate tissue of the system, to restore lost powers, to augment the powers which before existed, and in every way improve man's capabilities of mental and bodily enjoyment:—In all this we behold *the wisdom and the love of* God. We have likewise seen how, through the ill-construction of public buildings and private dwellings, Nature's loving designs are constantly being thwarted; how in the dormitories even of the wealthy, how even in our schools, which should be as ensamples of the best way to live, the lungs are constantly forced to inhale the poisons which they are designed to eject; we have glanced at the dwellings of the poor, and I trust felt shocked at their condition; we have glanced at some of the poison-beds scattered through the kingdom, have reflected on the volume and malignancy of the poisons generated, have seen that they must be diffused throughout the country, and, in a more or less diluted state, must be constantly entering the lungs of millions of human beings, to the certain injury of all their fine-wrought organs: — In all this we perceive *the ignorance and selfishness of man.* The laws of Nature are all on our side; but I repeat that if we would be as happy as we may be, we must struggle for ourselves as Nature struggles for us, and ever let us bear in mind that man never struggles so successfully for himself, as when he struggles for the good of the generality.

I have ventured to detain you at more than usual length this evening, because our subject has been one of such fearful importance, and one on which our people are so fearfully uninformed. If the generality could but be made aware of the kind of organ with which they trifle when they infringe the law of respiration, they would then be more regardful of ventilation, and more careful not to let impurities surround their dwellings. And surely if Governments were more alive to the fact that not the neglected poor alone, but *every* inhabitant of an ill-cleansed district must day by day be imbibing more or less of poison, which, though it may not seem to occasion positive disease, must render the entire man less physically, intellectually, and morally capable than he might be, less strong to resist morbific influences, and therefore more liable to be attacked, not only by any particular epidemic which may be prevailing, but by sicknesses and diseases of every kind,—if these things were more reflected-on by those whose chiefest duty, whose grandest ambition, should be to act as the guardians of the nation's health —its physical, intellectual, and moral health,—if, I say, these things were more reflected-on *by those in power*, surely they would be less dilatory in enforcing such sanitary measures as would undoubtedly be the means of saving the lives of tens of thousands yearly. Year after year, year after year, have Registrars' Reports declared the thousands dying of preventable diseases, and yet these diseases are not prevented. Year after year has it been stated that from preventable causes death is twice as busy among the poor as among the rich, and yet do a double number of the poor die on. Year after year has it been demonstrated that preventable typhus is annually destroying upwards of thirty thousands of our people, and yet by preventable typhus are upwards of thirty thousands annually destroyed.* How can we account for this apathy? Whence springs it? What is the cause? Are these slaughters permitted through cold-heartedness? through ignorance? through a want of power to save? But the facts are known; the power to save exists; and yet these things continue. Can we conceive a body of men, engifted with a mightier privilege than that of being permitted to stretch out the right hand of salvation to hundreds of thousands of crushed and trampled human beings? to give them health? to give them better powers? powers of thought, powers of action, powers of doing good, powers of being happy? Can we, I say, conceive a mightier earthly privilege than this? Yet this is possessed—has been for years possessed by legislators, and things are as they are :—*One-hundred-thousand suffering fellow-creatures are annually perishing in England from preventable diseases.* We may not now stop to calculate the national expense of this mortality, the pauperization, the destitution, the widowhood, the orphanage, the crime, the taxes on public and private benevolence, which such wrongs must occasion. Of these another time. Only let it from this hour forth be deeply impressed upon the hearts of all here assembled, that *one-hundred-thousand*— ONE-HUNDRED-

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* A *very low* estimate for Great Britain and Ireland. In '48 typhus destroyed upwards of 30,000 human beings in England alone.

THOUSAND human beings are annually perishing in England from preventable diseases.

But O, still deeper shame! The land holds numbers—numbers bearing the name of Christians too—who talk of these slaughters as "part of the Eternal Scheme!" and actually seem to believe them so, *for the thinning of o'er-peopled countries!* And can such bend in prayer? in prayer to One whom they look upon as *Devil?* upholding his government by cruelty and wrong? mocking his creatures by giving them laws which may not be broken without sin and suffering, but yet which *shall* be broken to suit his purposes? God helping, I will one day show that where death is most busy there births are most numerous;—that so far from the present state of things *keeping-down* population, it *augments*, in the long run, the bulk of those very classes which are an immense anxiety and enfeeblement to the country. For the present simply this to the NATION:—If you conceive the sacrifice of human victims to be a fearful sin in the sight of Heaven, then surely you will raise your cry that this sin shall be out-rooted from our land; but if it be indeed the pleasure of the *Deity* that one-hundred-thousand of our people should be slaughtered yearly—then, in Religion's name, why longer trouble him to send his plagues?—Appoint your butcher priest; erect an altar; call your God MOLOCH; and show your love to him by the annual voluntary sacrifice of one-hundred-thousand children.*

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* For the sake of round numbers, the words "one-hundred-thousand" have been used in the text above. In a Paper lately drawn-up under the supervision of the General Board of Health, and entitled "Comparison of the Cost in Life, of War, and Pestilence, and Civil Violence," the average annual deaths in England from preventable diseases—*i.e.* from "typhus and other zymotic diseases"—are estimated at *one-hundred-and-fifteen* thousands. Thus, under the present system, *considerably more than one million human victims are sacrificed in England every ten years.*

These calculations are made by comparing the mortality of healthy districts with the mortality of other districts rendered unhealthy by known and removable causes. But it cannot be supposed that even the healthiest districts are so healthy as they might be. If it be granted that the death-rate for the whole country might be reduced as low as in some of the "Model Dwellings," the preventable deaths in England are (as shown in the Report on the Administration of the Public Health Act, p. 30) *very much understated* at one-hundred-and-fifteen thousands per annum.

Obs.—Those who would scrutinize for themselves the truth of the assertion that "So far from the present state of things keeping-down population, it augments, in the long run, the number of those very classes which are an immense anxiety and enfeeblement to the country," are referred to Mr. Chadwick's Supplementary Report on the Practice of Interments in Towns, p. 248 *et seq.*, and to the arguments and opinions of Dr. Playfair, Mr. Clarke, and others, in the Report of the General Board of Health on the Epidemic Cholera, p. 76, *et seq.*

The simple facts of the case "proved by indubitable evidence," may be briefly summed up as follows:—

Where neighbourhoods are filthy, and people of both sexes and of all ages are compelled to herd together like filthy animals, where "appetite and instinct occupy the place of higher feelings," where early unions are common, and virtue impossible, *there* we do not find "a diminishing or even a stationary population." However high the mortality in such districts, it is "invariably followed by a more than proportionate excess in the number of births;" and, as a general rule, it may be stated that, *Where the causes of mortality press most heavily, "where the average age of death is the lowest and the duration of life the shortest, there the increase of population is the greatest," and there degeneration proceeds most rapidly.*

APPENDIX.

No. I. (*text*, p. 15).

RESPIRATORY SURFACE IN THE HUMAN LUNGS.

It is not to be expected that the physiologist will ever be able to arrive at more than an approximation to truth as to the average extent of respiratory surface in the human lungs. Even among individuals of the same age, both the *number* and the *diameter* of air-cells vary extremely; and such will of course continue to be the case as long as the laws of development are so little regarded as at present. In the lungs of the over-worked needle-woman, or of the dyspeptic weaver, the respiratory surface is, beyond doubt, less by several feet than in the lungs of the sturdy rustic or of the Thames boat-man. Assuming, however, that these organs in the adult human being contain, upon an average, 600 million cells (*M. Rochoux*), and that the 1-100th of an inch is a fair average measurement of a cell-diameter (*Hales*), then, under the supposition that the internal surface of each cell is equal to that of a hollow sphere of the same internal diameter, (which is probably about the truth)—

$$\overset{\text{in.}}{\left(\tfrac{1}{100}\right)^{2}} \times 3{\cdot}1416 = \overset{\text{in.}}{{\cdot}00031416} = \text{internal surface of a single cell;}$$

$$\text{and } \overset{\text{in.}}{{\cdot}00031416} \times 600000000 = \overset{\text{in.}}{188496}:$$

thus the respiratory surface of the human lungs would equal 188,496 square inches, or 1,309 square feet, or nearly 145½ square yards (*Rochoux* and *Hales*).

According to the more recent researches of Weber, the diameters of the cells vary "from the 1-200th to the 1-70th of an inch;" and if we take 1-200th of an inch as the average diameter of 300 millions of them, and 1-70th of an inch as the average diameter of the remaining 300 millions, we may calculate as follows:—

$$\overset{\text{in.}}{\left(\tfrac{1}{200}\right)^{2}} \times 3{\cdot}1416 = \overset{\text{in.}}{{\cdot}00007854} = \text{internal surface of a cell 1-200th of an inch in diameter,}$$

and $\overset{\text{in.}}{\cdot 00007854} \times 300000000 = \overset{\text{in.}}{23562}$ = internal surface of 300,000,000 such cells;

$\overset{\text{in.}}{(\tfrac{1}{70})^2} \times 3\cdot1416 = \overset{\text{in.}}{\cdot 000641141574857784}$ = internal surface of a cell 1-70th of an inch in diameter,

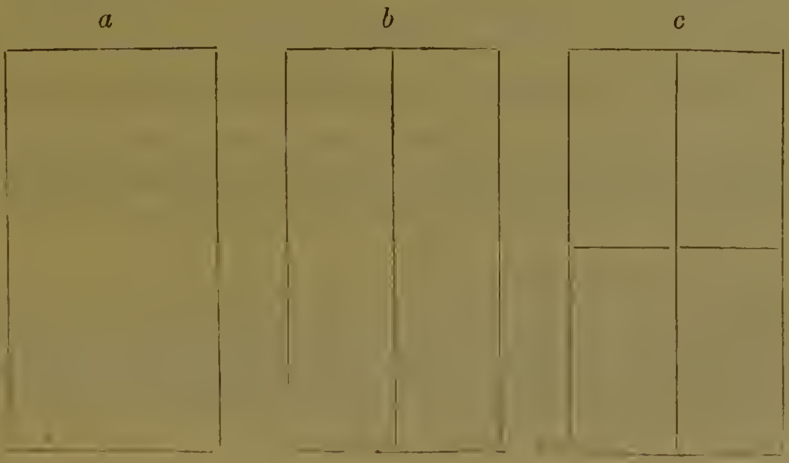
and $\overset{\text{in.}}{\cdot 00064114\ \&c.} \times 300000000 = \overset{\text{in.}}{192342\cdot4724573352}$ = internal surface of 300,000,000 such cells;

$$\overset{\text{in.}}{23562} + \overset{\text{in.}}{192342\cdot47245\ \&c.} = \overset{\text{in.}}{215904\cdot4724573352}:$$

and thus the respiratory surface of the human lungs would equal 215904·4724573352 square inches, or 1499·33644762038⅓ square feet, or rather more than 166½ square yards. If the interiors of the air-tubes which join the cells with the trachea were taken into consideration, these numbers would be raised still higher.

The following extract from Dr. Carpenter's Animal Physiology explains very distinctly how it is possible for the human lungs to present so vast a surface to the action of the atmosphere:—

"We may," says the writer, "for the purpose of explanation, compare the lung to a chamber, on the walls of which blood is distributed, and to the interior of which air is admitted. This chamber, for the sake of convenience of description, we shall suppose to have two long and two short sides, as at *a*. Now, if a partition be built-up in the direction of its length, as at *b*, a new surface will be added equal to that which the two *sides* previously exposed; since *both* the surfaces of this partition are supplied with blood, and are exposed to the air. Again, if another partition be built-up across the chamber, as at *c*, a new sur-



face will be added, equal to that which the *ends* of the chamber previously exposed. And thus, by the subdivision of the first chamber into four smaller ones, the extent of surface has been doubled. Now, if each of these smaller ones were divided in the same manner, the surface would again be doubled ; and thus, by a continual process of subdivision, the surface may be increased to almost any extent compatible with the free access of air to the cavities and of blood to the walls." *

Supposing a box of cubic form, a side of which measures no more than seven inches, were to be thus divided and subdivided until each division represented a cube a side of which should measure the 100th of an inch, there would be produced about 343,000,000 cubes, and the surface presented by all these cubes taken together would equal 158 yds. 7 ft. 24 in. ; and supposing these divisions were to be once more subdivided, so that a side of each cube should measure the 200th of an inch, there would then be about 2,744,000,000 cubes, and the surface presented by them collectively would equal 316 yds. 14 ft. 48 in. These are not put forth as *strictly* accurate computations, inasmuch as, for the sake of simplifying, no account is taken of the spaces occupied by the parietes of the cells, which spaces (if we assume the 3,000th of an inch for the thickness of each) would collectively take-up about half an inch of room in each side of a cubic box divided into 2,744,000,000 cubic divisions. The results arrived-at, however, are sufficient to demonstrate that the human lungs are not hindered through lack of room from presenting to the action of the air a surface of *considerably more* than 166½ square yards.†

No. II. (*text*, p. 18).

VOLUME OF AIR DAILY INHALED BY THE HUMAN LUNGS.

Physiologists have laboured with great assiduity to determine the volume of air daily inhaled by the human lungs; and while some estimate it at about 60 hogsheads, others believe it to be considerably less.* But the arguments of all seem based upon the supposition *that the body and mind remain tranquil during the entire day.* Few men, if any, have given more careful attention to the matter, and probably none have arrived at more accurate conclusions thereon, than Dr. Southwood Smith, who, however, *professedly* makes his calculations dependent upon the proviso that none but "ordinary respirations, made without any effort at all," take place in the course of the 24 hours. In other words, the heart is supposed to be beating throughout the day and night at the quiet rate of about 72 pulsations per minute. With such stipulation, he considers that there enter the lungs in the course of an hour about 1066⅔ pints of air. According to this estimate 59 hogsheads 14 gallons will enter the lungs daily.†

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* Animal Physiology, § 312.

† Since calculating the lung-surface as above, the writer has met with the following passage :—" The number of air-cells in the two lungs has been estimated at 1,744,000,000, and the extent of the skin which lines the cells and tubes together at 1500 square feet (or 166½ square yards). This calculation of the number of air-cells and the extent of the lining membrane rests, I believe, on the authority of Dr. Addison, of Malvern."—*Treatise on the Management of the Skin, &c., by Erasmus Wilson, F.R.S.*, p. 28.

The following calculations are suggestive of the average volume of air inhaled during 24 hours (1) by *an ordinary male adult when taking the amount of muscular exercise requisite for the maintenance of robust health;* and (2) by *an athletic adult during a day occupied in exercises of an unusually vigorous kind.*

Adult male taking the amount of exercise requisite for robust health.

hours.			pints.	pints.
uring 4	he breathes 30 times per min.;	7,200 times in all:	and inhales 1½ at each inspiration;	10,800 in all.
uring 4	he breathes 25 times per min.;	6,000 times in all:	and inhales 1¼ at each inspiration;	7,500 in all.
uring 4	he breathes 20 times per min.;	4,800 times in all:	and inhales 1 at each inspiration;	4,800 in all.
uring 4	he breathes 17 times per min.;	4,080 times in all:	and inhales ⅚ at each inspiration;	3,400 in all.
uring 8	(sleep) 15 times per min.;	7,200 times in all:	and inhales ¾ at each inspiration;	5,400 in all.
24		29,280		31,900

Thus, during the 24 hours, he breathes 29,280 times, being at the average rate of 20·3 respirations per minute; and inhales altogether 31,900 pints of air, being at the average rate of 1·08 pints at each inspiration :—

---

* which it undoubtedly is in very many cases where, through infringement of the law of exercise, the lung-cells have not been fully developed.

† Here, and throughout these pages, the hogshead is reckoned at 54 gallons.

pts.		gals.		hhds.	gals.
31,900	=	3,987½	=	73	45½.

When it is considered what a very small degree of muscular exertion is requisite to increase the action of the lungs *beyond* the rate of 30 inspirations per minute, and how very frequently it happens that *above* a pint and a half of air is being inhaled at each successive inspiration (*the volume inhaled at a single inspiration increasing, as a general rule, as the rapidity of breathing increases*), it seems scarcely to admit of a reasonable doubt but that a very large number among our industrious classes inhale, during the greater portion of the year, *considerably more than* 73 *hogsheads of air per diem.*

Athletic adult during a day of severe muscular exertion.

	hours.*			pints.	pints.
During	1	he breathes 60 times per min.;	3,600 times in all;	and inhales 2 at each inspiration;	7,200 in all
During	2	he breathes 40 times per min.;	4,800 times in all;	and inhales 1⅚ at each inspiration;	8,800 in all.
During	4	he breathes 30 times per min.;	7,200 times in all;	and inhales 1¾ at each inspiration;	12,600 in all
During	2	he breathes 20 times per min.;	2,400 times in all;	and inhales 1¼ at each inspiration;	3,000 in all
During	8	he breathes 18 times per min.;	8,640 times in all;	and inhales 1 at each inspiration;	8,640 in all.
During	7	(sleep) 16 times per min.;	6,720 times in all;	and inhales ⅚ at each inspiration;	5,600 in all
	24		33,360		45,840

Thus, during the 24 hours, he breathes 33,360 times, being at the average rate of 23·16 respirations per minute; and inhales altogether 45,840 pints of air, being at the average rate of 1·37 pints at each inspiration :—

pts.		gals.		hhds.	gals.
45,840	=	5,730	=	106	6.

In these latter calculations, the man is supposed to be of somewhat stronger and larger mould, and of a more active temperament; and he is further supposed (as already stated) to be occupied during a considerable portion of the day in exercises of an unusually vigorous character. Nevertheless, this is not put forward as an extreme case. A careful observation of facts will be sufficient to convince the reflecting mind that *an amount of air which, if collected, would far exceed* 106 *hogsheads, is not unfrequently diffused over the respiratory surface of the human lungs in* 24 *hours.**

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* These periods (that of sleep may be excepted) are not supposed to be made-up of *consecutive* minutes.

No. III. (*text*, p. 30).

"MARK HOW YOU ARE SAPPING THE FOUNDATIONS OF YOUR OWN STRONG TOWERS."

From tables prepared by Mr. Marshall, Deputy Inspector of Hospitals, and quoted by Dr. Gavin in his Lecture on the Habitations of the Industrial Classes,† it appears that during the five years, 1833-7, the rejections of recruits as unfitted to bear arms were –

in Dublin, 59·1 — 71·7 — 55·3 — 40·7 — 46·5 per cent. ;
in Edinburgh, 43·5 — 56·5 — 48·5 — 48·9 — 57·1 per cent. ;
in London, 34·0 — 45·1 — 38·4 — 36·0 — 42·2 per cent. :

making in the aggregate an average of nearly 50 per cent.‡ rejected in the three capitals, which are by no means so unhealthy as many of our towns.

To realize something of the enormity of this evil, let the reader reflect, that if it were required to raise from among our town or city populations an army of a hundred thousand men, and a hundred thousand men were to offer for the occasion, about *fifty thousands of them,* judging from these tables, would be rejected as *incapable.*

When it is borne in mind that by far the greater part, if not the whole, of the causes which render so large a portion of the people unfit to be the defenders of their country, are *preventable;* and further, that if nurtured under a more strict observance of the laws fixed by God in Nature, even the strongest men of the present generation might have been still stronger, it is not too much to argue that by carrying out efficient measures of sanitary reform, and by training every member of the British family to the knowledge and observance of the laws of health, the power and majesty of the empire might be at least doubled—and this without the addition of so much as one man to the numerical strength of the nation.

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* Among youths engaged in athletic sports (foot-ball, foot-racing, cricket, &c.), the writer has frequently observed the lungs working at the rate of upwards of seventy heavings per minute. During this extraordinary action (which of course cannot be maintained for any length of time without great distress), considerably more than the usual volume of air is inhaled at each successive inspiration.—The *average* volume which the lungs of well-developed adults *can* inhale, "appears to be from five to seven pints: the *greatest* volume hitherto found to have been received by the lungs, on the most powerful inspiration, is nine pints and a quarter."—*Philosophy of Health*, vol. II. § 421.

† Page 64.

‡ 48·2⅔ per cent.

But the tables, as quoted above, refer to 1833-37: since which time, however, it is to be feared that there has been a "retrograde movement" in the public health. Epidemics have become more frequent, typhus and all zymotic diseases more fatal, and the degeneration of large bodies of our people has been going on more rapidly.

The following passage, from Dr. Farr's Report on Cholera, affords matter for deep thought:—

> "While the drainage of the marshes, the cultivation of the soil, the sanitary measures in the old towns, and the diffusion of education, have tended to promote the amelioration of the English race; the descent of the population in the low places, which have in the last ten years *increased twice as fast as the healthy parts*—the sudden growth of large mining and manufacturing places left undrained, ill-cleansed—the liberation of multiplying vagabonds and criminals who were in the old times transported, cruelly destroyed by jail-fever, or hanged, have had a tendency to *increase the proportion* of deteriorated organizations. *Idiots and lunatics*, who are no longer plunged in cells for a short life, and other persons labouring under hereditary diseases, *are also increasing*, probably from a similar cause. In addition to the inhabitants of the old towns which have always been fatal, *several millions* of the people are now in the seaports, in South Wales, in Staffordshire, in the mining districts of the north, in the towns of the West Riding of Yorkshire, and in the dense districts of Lancashire, where the health of parents is depressed, and the circumstances are often so prejudicial to their offspring, that *of the coming generation,* FIVE *instead of two of every ten born are destroyed in the first five years of life*, and the survivors, with a few happy exceptions, are left *with shattered, feeble, febrile, and disorganized frames.* The countenance of the children is painful in these districts; and in all the places where cholera has raged, presents the most striking contrast to the healthy, hardy aspect of the children in salubrious fields. *Their degeneration is as inevitable as the degeneration of horses, oxen, sheep, in circumstances equally unfavourable.* . . . It is probable that *more than one-fourth part of the next generation of the*

English race will be born and bred in insalubrious places, which must in the long run induce degeneracy. The proportion of such births is RAPIDLY INCREASING. Is it not time, then, to take heed? Are we not on the verge of a great calamity? This question is more than a question of life and death for the people. *If degeneration should extend, and large numbers of the English race be divested of its noblest characteristics, their reclamation would be an arduous if not impracticable undertaking. For while nature in time supplies a loss of numbers, it is difficult by the most consummate art, even in favourable circumstances, to retrieve the loss of generous qualities. How few genuine instances are there of the regeneration of a fallen man, class, or nation!*"*

No. IV. (*text*, p. 36).

NECESSITY OF HOUSES OF RECEPTION FOR THE DEAD.

The following extracts are inserted with a hope that they may help to spread the opinion, entertained by all who have studied the social condition of the poor, that *houses of reception for the dead previously to interment* ought, with as little delay as possible, to be largely established throughout the kingdom.

"There are some houses in my district," says Mr. Leonard, the medical officer of the parish of St. Martin's-in-the-Fields, "that have from 45 to 69 persons of all ages under one roof; and in the event of death, the body often occupies the only bed, till they raise money to pay for a coffin. . . . In one instance, (in which) the corpse had been retained twelve days, I could not remain in the room two minutes, from the horrible stench. The coffin stood across the foot of the bed, within eight inches of it; this was a small room, not above ten feet by twelve feet square, a fire being always in it; it was, as in most cases of a like kind, the only room for sleeping, living, and cooking in. In another instance, a mother and her infant were brought ill with fever to her father's room, which was ten feet square, with a small window of four panes;—the infant soon died; then the grandmother was taken ill, and, in a few days, she also died; the corpse of the grandmother lay beside her husband in the same bed; in the next place the husband was seized with fever, attended with violent delirium, and died; and subsequently two of his children, one within a week, and the other within ten days, fell victims to the disease; in short, five out of the six inmates of this room died.—Found in another similar room the corpse of a young person who had died of fever; the father and mother were just taken ill of the same disease; the foot of the coffin was within ten inches of the father's head as he lay upon his pillow, himself in a fever; in a few days another child was seized with the same disease.—Cites these cases merely as examples of the fatal consequences of the long retention of the body in these small and crowded rooms;—they could be multiplied indefinitely."

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* Report (from the General Register Office) on Cholera in England, p. xcvii.

"Nearly the whole of the labouring population in my district," says Mr. John Liddle, medical officer of the Whitechapel Union, "have only one room; the corpse is therefore necessarily kept in that one room, where the inmates sleep and have their meals; the corpse being sometimes stretched on the bed, the bed and bed-clothes being taken off, and the wife and family lying on the floor; at other times the corpse is stretched on a board which is placed on chairs. When children die, they are frequently laid-out on a table. Other deaths often follow the first death in the same family, especially in an epidemic season."

Mr. Byles speaks in similar terms of the condition of affairs in Spitalfields:—"he has known numerous instances of the extension of death through families," by the too long retention of a corpse.

On the adjacent district of Bethnal Green, Mr. Bestow, the relieving officer, thus remarks:—

"In the majority of cases, the weavers live and work in the same room; the children generally sleep on a bed pushed under the loom; before a coffin is obtained, the corpse is stretched on the bed, where the adults have slept: serious evils result from the length of time during which bodies are kept under such circumstances; has known as many as eight deaths from typhus follow, from the long retention* of the body in the case of the first death, namely, five children and three visitors."

If the following should appear too sadly revolting to the delicate mind, the writer may be permitted to remind the reader that the shame is not that such things be *exposed,* but that they *exist.*

Mr. Wild, the undertaker, states—

"Three-fourths of the rooms he has visited are single rooms—the only room the poor people have to live in; generally speaking, finds only one bed in the room, and that occupied by the corpse. . . In cases of rapid decomposition there is sometimes much liquid, and the coffin is tapped to let it out; has known them keep the corpse after the coffin has been tapped twice. This liquid generates animal life very rapidly; and within six hours after a coffin has been tapped, if the liquid escapes, maggots, or a sort of animalcules, are seen crawling about. I have frequently seen them crawling about the floor of a room inhabited by the labouring classes, and about the tressels on which the tapped coffin is sustained. In such rooms the children are frequently left whilst the widow is out making arrangements connected with the funeral. And the widow herself lives there with the children. I frequently find them altogether in a small room with a large fire."

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* Most witnesses examined mention the expense of the funeral as a principal cause of these long retentions.

Mr. Hogg, sexton, of St. Mary's, Paddington, in evidence recently taken by Dr. Milroy, states—

> "That among the poorer classes . . . if a person dies on Thursday or Friday, the body is seldom buried before the second Sunday following. He has been repeatedly obliged to forbid the coffin being taken into the church—to the great offence and grief of the mourners—in consequence of the horrible effluvia often perceptible many yards off. He has on such occasions seen the sleeves of the bearers quite dripping with the sanies that leaked from the coffin. How the men can stand the disgusting employment, walking, as they often have to do, for a mile or more under a pall all the while, and this too generally in warm weather (for the occurrence is most frequent then), is indeed surprising. No wonder that they usually drink to excess after such work."

Mr. Upton, sexton of Bunhill-fields burial-ground, says—

> "He has repeatedly seen the putrid discharge from the coffin dripping down along the clothes of the undertaker's men who carried it; so that the whole line of the funeral procession, from the gate to the grave, might be traced by the drippings on the ground!"

Mr. Jeffreys, an undertaker residing at Whitechapel, says—

> "I have known corpses to be kept three weeks. We every week see them kept until the bodies are nearly putrid; sometimes they have run away almost through the coffin, and the poor people, women and children, are living and sleeping in the same room at the same time."

The Earl of Shaftesbury recently stated in the House of Lords that

> "He had known of instances where dead bodies had been kept ten, twelve, fourteen, and even eighteen days in a single room, already occupied by ten living persons."*

On the same occasion, the Bishop of London expressed his opinion that *these evils were increasing.*

To form an idea of the aggregate of misery shadowed forth in the preceding paragraphs, it must be borne in mind that in London alone (as shown at p. 35) upwards of 20,000 deaths occur every year "in families possessing but one living and sleeping room;" and that the number of deaths occurring under a similar or worse condition of circumstances throughout Great Britain and Ireland, would, so far as can be judged of by statistics, be under-stated at 250,000. In other words, within the Queen's home dominions, there occur every year upwards of 250,000 instances of the members of a family or combination of families, being compelled to undergo, and often for several consecutive days, a state of abject wretchedness, too sickening to be thought on without loathing. Nor is the matter in any way mended by reflecting that frequently six or eight of these 250,000 yearly retentions of the dead among the living, are repetitions, or lengthened continuations, of this revolting misery in the same family or *families.**

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* *Times*, March 28, 1854.—The remaining extracts above quoted may be found, among many others of a similar kind, in the *Report (from the Health Office) on a General Scheme for Extramural Sepulture*, p. 102 *et seq.*

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* The reader will remember that "three, four, or five families" often occupy a single room about twelve feet square. Of course the heat thus engendered causes corruption to proceed with unusual rapidity.

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